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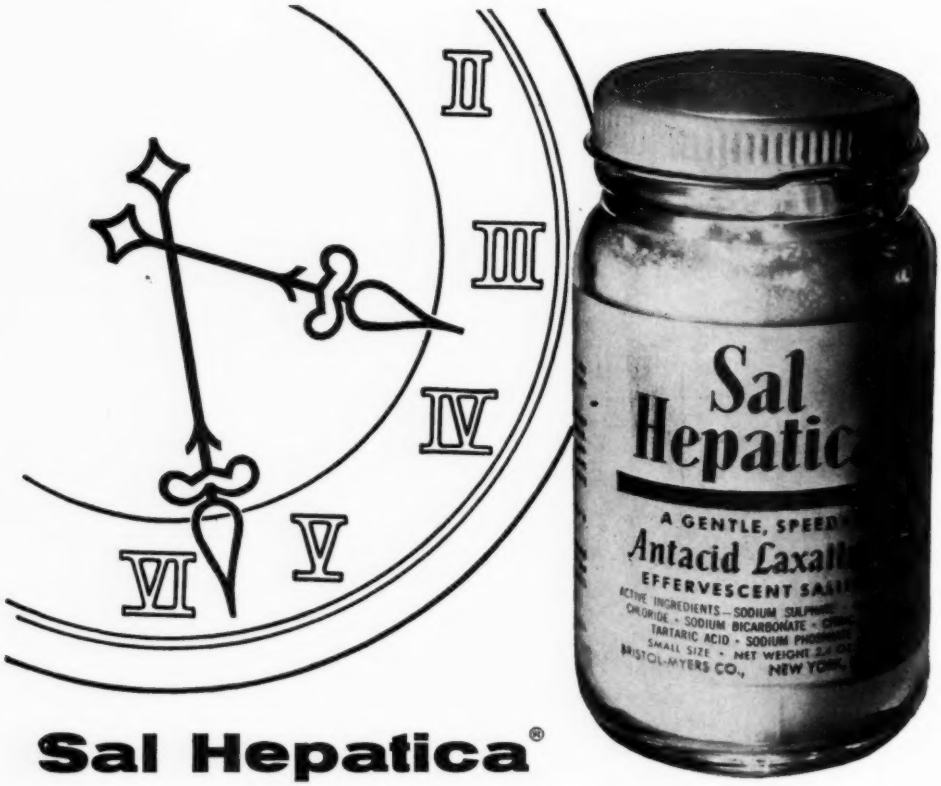

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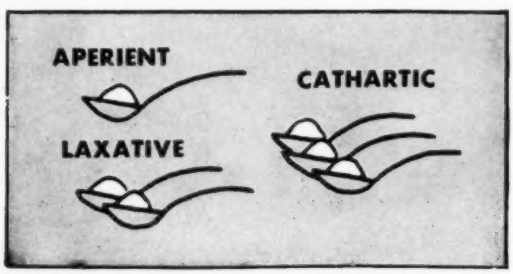

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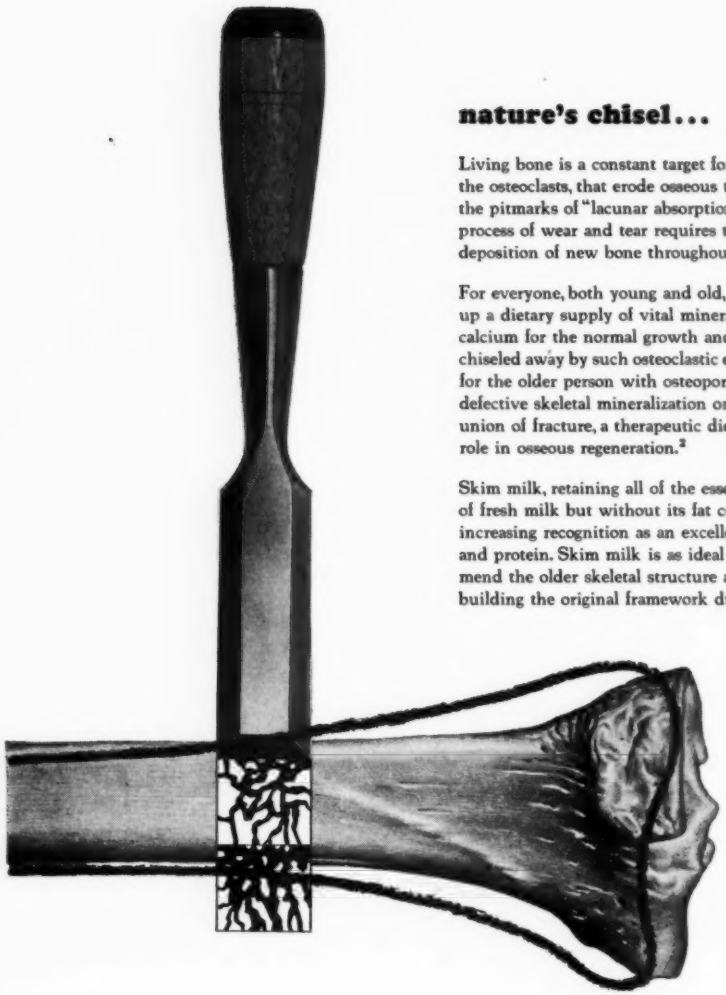

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[1] Swenson, P. C., and Jeffery, R. B. : G. P. 7:34 (Feb.) 1953.
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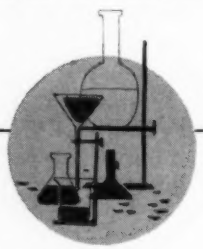

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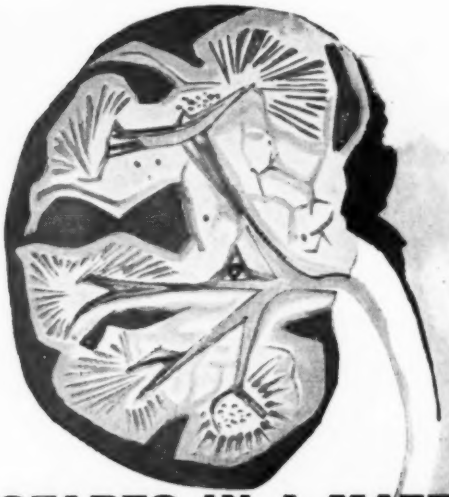

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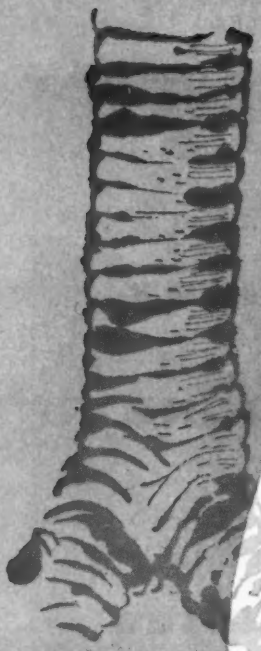

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2. *Waddington, W. S.; Bergy, G. G.; Nielsen, R. L., and Kirby, W. M. M.: Am. J. M. Sc. 228:164 (Aug.) 1954.*

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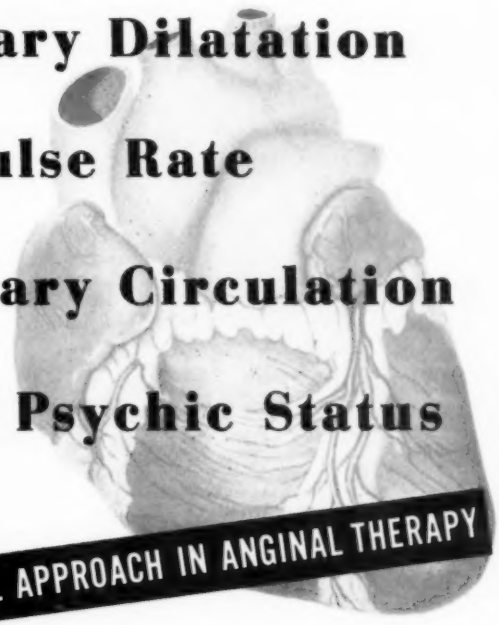

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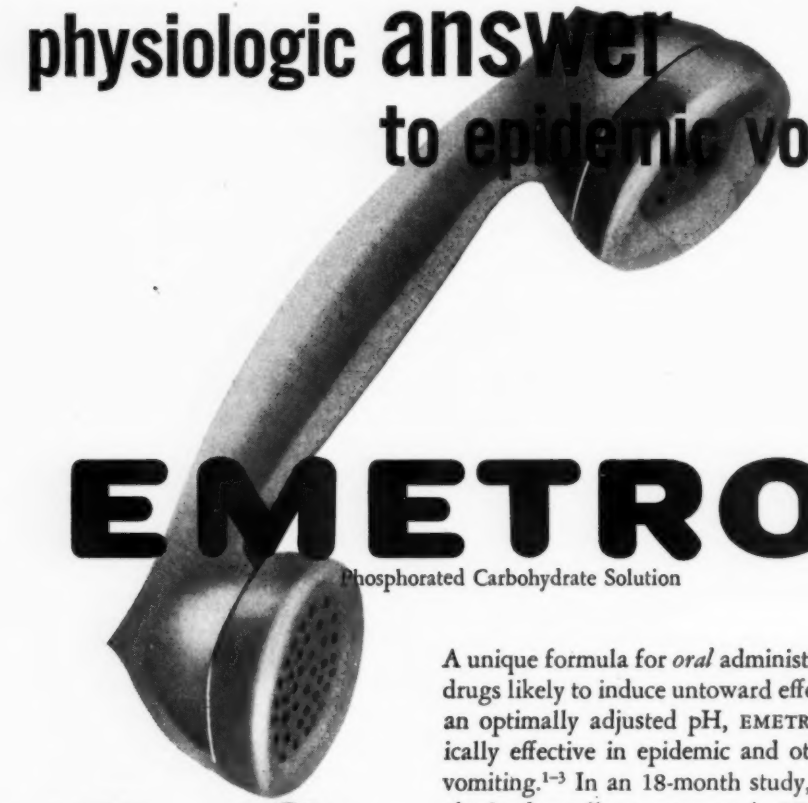
physiologic answer to epidemic vomiting



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IMPORTANT: EMETROL must always be taken *undiluted*. No fluids should be allowed for at least 15 minutes after each dose.

DOSAGE: For infants and children, 1 or 2 teaspoonfuls every 15 minutes until vomiting stops. For adults, 1 or 2 tablespoonfuls.

SUPPLIED: In bottles of 3 fl.oz. and 16 fl.oz., through all pharmacies.

in nausea of pregnancy, EMETROL has produced favorable response in 3 out of every 4 cases, usually within 24-48 hours.[2] Recommended as "free of annoying side effects . . . a safe and physiologic agent . . ."

1. Bradley, J. E., et al.: J. Pediat. 38:41, 1951. 2. Crunden, A. B., Jr., and Davis, W. A.: Am. J. Obst. & Gynec. 65:311, 1953. 3. Tebrock, H. E., and Fisher, M. M.: M. Times 82:271, 1954.

Literature and sample on request

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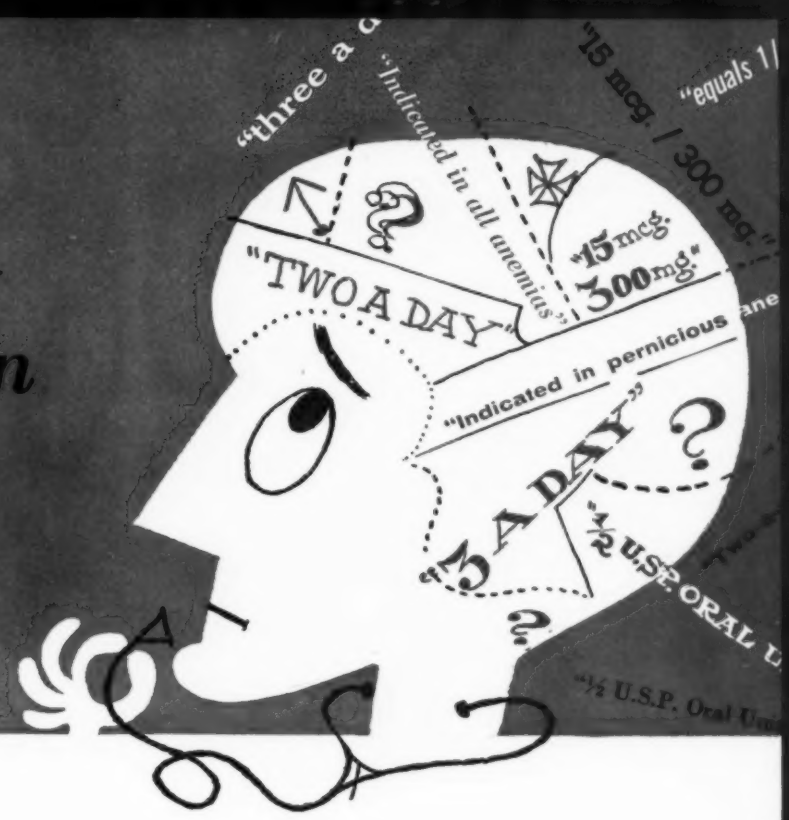
end the confusion about hematinics



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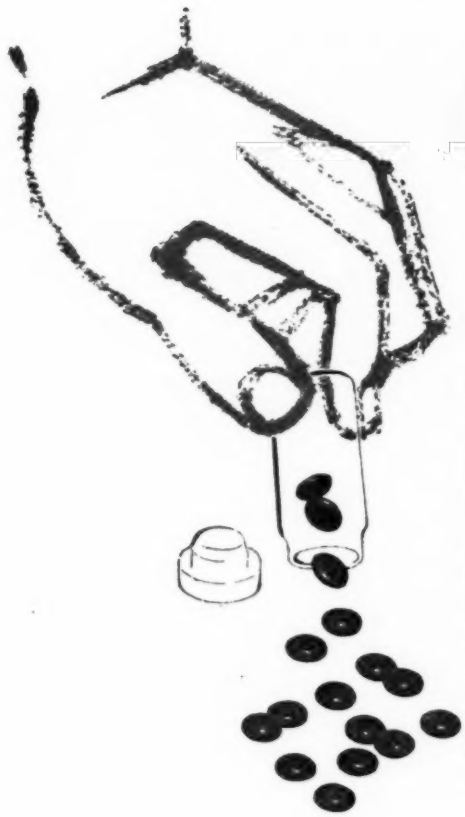

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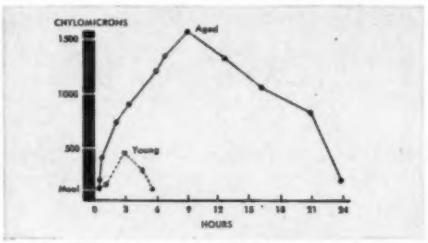
ATHEROSCLEROSIS

Revised concepts of etiology predicate new therapeutic approach

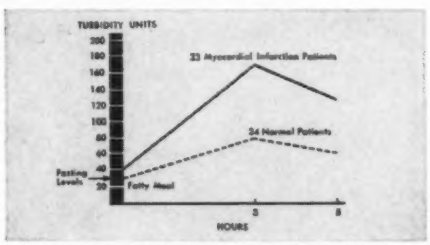
Recent studies attach increasing importance to the particle size and physical characteristics of certain blood lipids, rather than total serum cholesterol as such, in the genesis of atherosclerosis. Assays of neutral fat particles in the blood (chylomicra) following fat ingestion, and the closely related concentration of low-density "giant" lipoprotein molecules, show much greater correlation with clinical atherosclerosis than either the serum cholesterol level *per se* or the cholesterol-phospholipid ratio.

It has also been shown that (1) a high incidence of hypercoagulability and low blood heparin levels exist in patients with cardiovascular disease and atherosclerosis; (2) circulating heparin tends to decrease with age; and (3) an inverse ratio exists between the concentration of giant lipoprotein molecules and serum heparin levels.



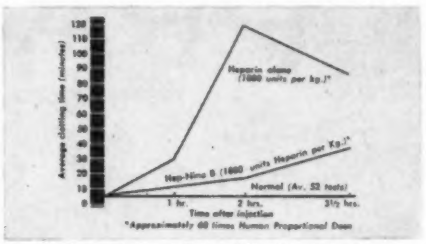
Chylomicron curves of fasting young and old subjects after a Standard fat meal. After Becker et al: Science 110:529, 1949.

Parenterally administered, heparin exerts a profound "clearing" action on chylomicra and the giant molecules. This action is independent of heparin's anticoagulant effect. In the treatment of atherosclerosis, the addition of choline and specific B vitamins appears to enhance heparin's efficacy. Vitamin B_{12} and folic acid aid in the synthesis of labile methyl groups and the transmethylation process. Choline specifically increases the phospholipid turnover, and parenterally administered, it has been shown to have a distinct vasodilating effect. *Most significantly, however, choline decreases the anticoagulant action of heparin, when both drugs are administered simultaneously at the same site, without impairing the clearing effect of heparin.* Thus the use of heparin for atherosclerotic diseases is rendered safe as a routine office procedure, without necessity for periodic clotting time determinations.



Fat Tolerance in Myocardial Infarction and Control Patients. From data of Schwartz et al: JAMA 149:364, 1952.

A preliminary clinical report* on HEP-NINE B —which combines heparin, choline, vitamin B_{12}, folic acid and niacinamide for intramuscular injection—indicates that the combination offers considerable promise in a variety of conditions in which atherosclerosis plays a part, such as angina pectoris, myocardial infarction, coronary disease, related kidney and liver diseases, diabetes mellitus, and certain



Comparison of effects of Hep-Nine B and Heparin alone on clotting time

cases of obesity. Pharmacologic studies showed no significant effect on coagulation time, even in dosage far exceeding that recommended. Chylomicron concentration was reduced promptly in all cases following a single injection, ranging from a minimum 29% reduction (diagnosis: anterior myocardial infarction) to a maximum of 100% (diagnosis: multiple cerebral thrombosis). In patients selected for a history of myocardial infarction or diabetes, the atherogenic index as determined by the Gofman Serum Lipoprotein Test was materially reduced in all cases without benefit of diet restriction. Of 30 patients with recurrent angina pectoris, 23 experienced marked reduction in frequency and severity of episodes. Nitroglycerine requirements were reduced and exercise tolerance was increased in all cases. No patient suffered coronary occlusion or myocardial infarction during the period of study.

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Niacinamide	50 mg.

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Send for complete information and references.

Read, J. T., and Obetz, R. C.: Clinical Experience with Parenteral Heparin-Lipotropic Therapy in Cardiovascular Diseases. Ohio State M. J. (In press).

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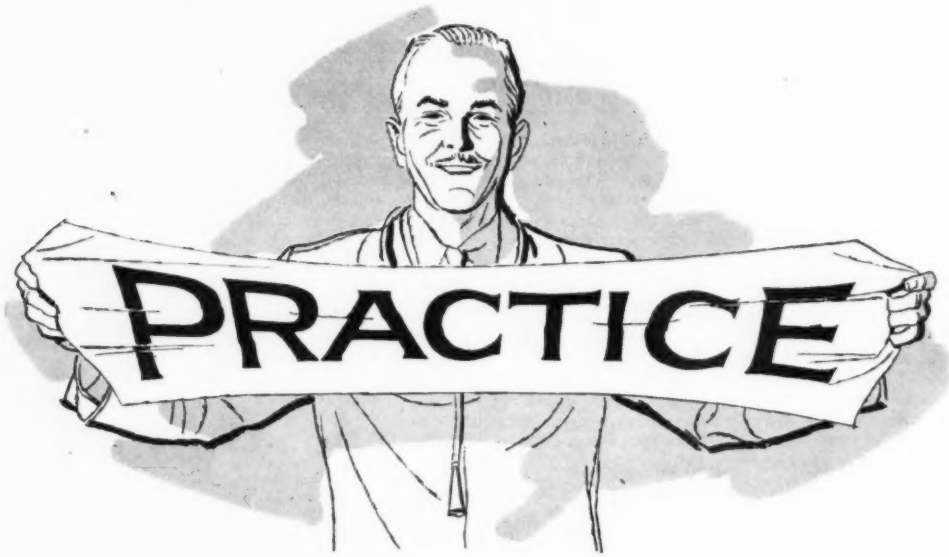

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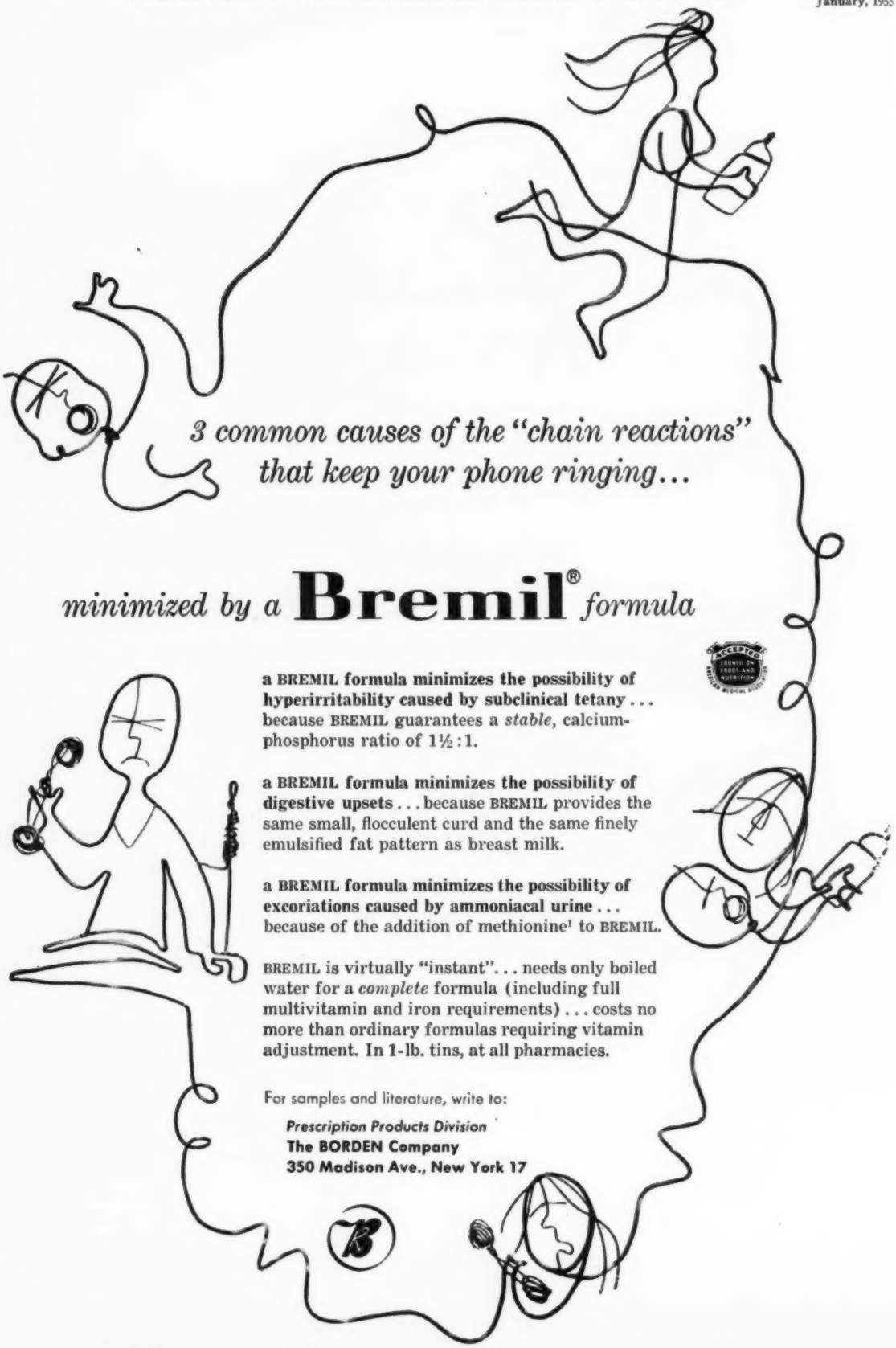

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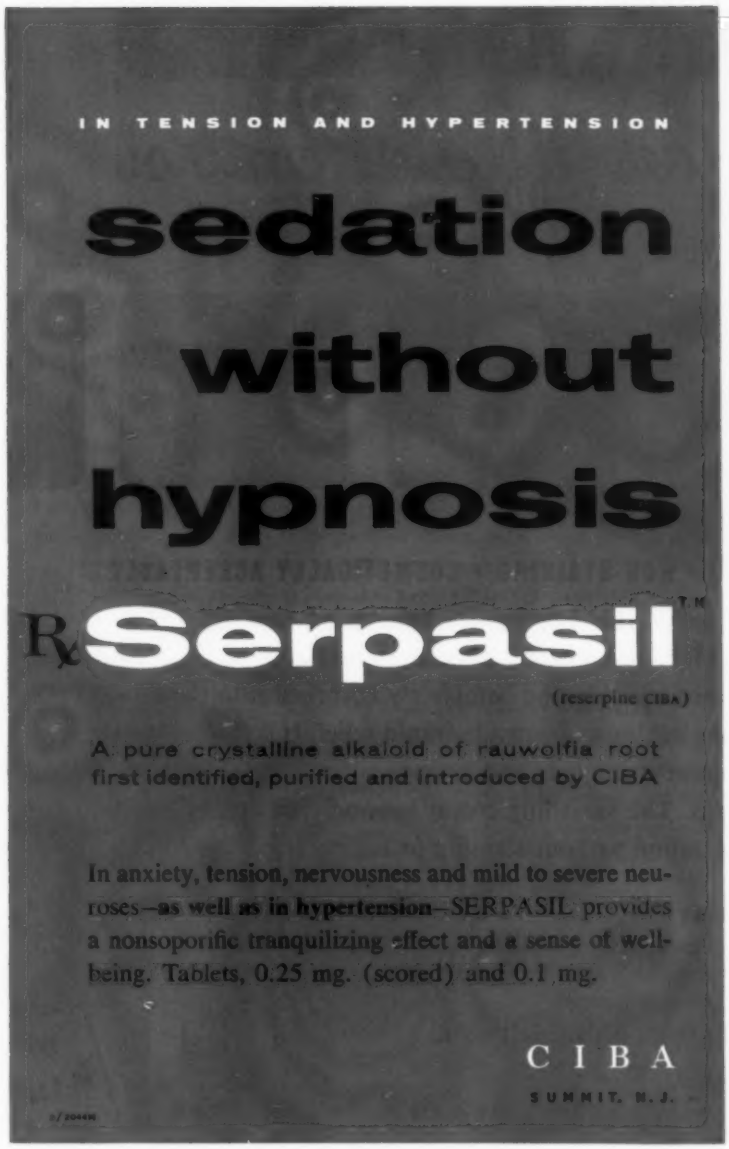
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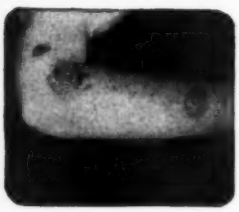

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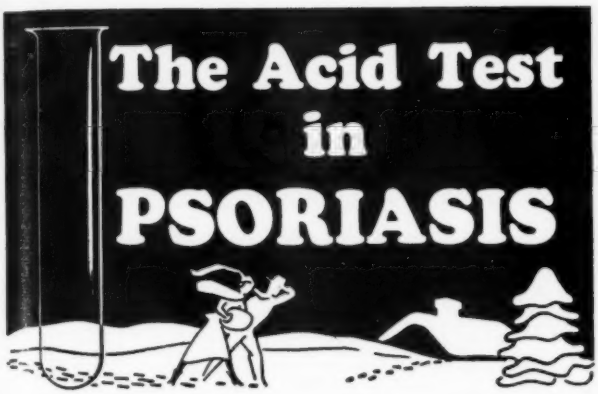

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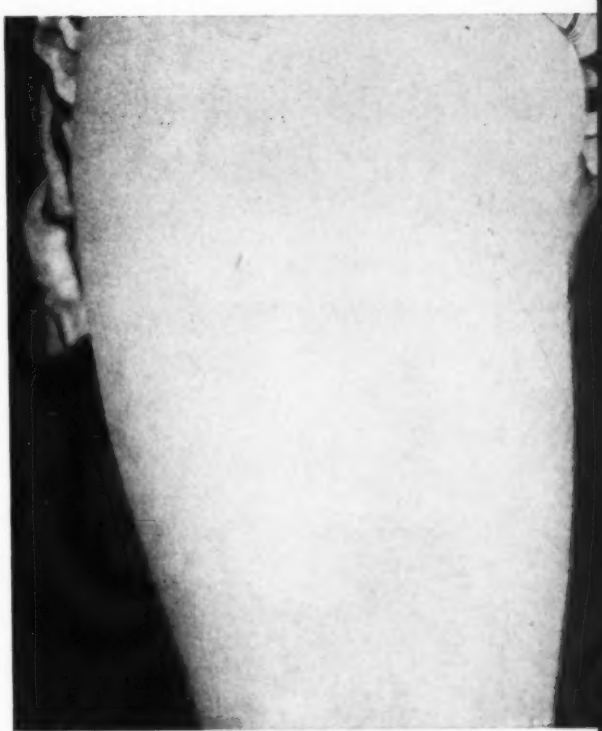

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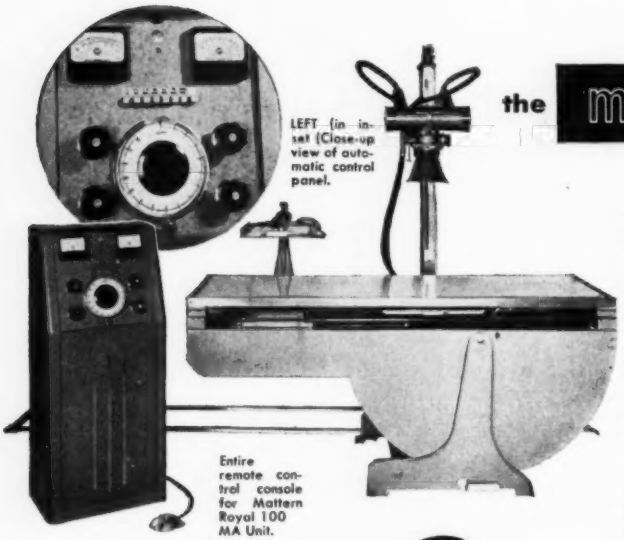

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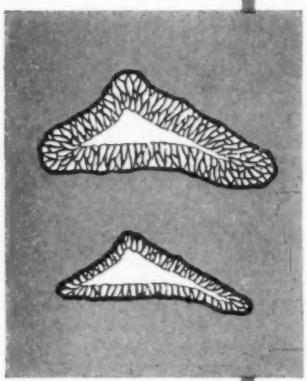

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Symposium on the Functional Implications of Segmental Facilitation

A Research Report*

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I. The Concept of Facilitation and Its Origins

IRVIN M. KORR, Ph. D.

INTRODUCTION

This symposium is a report on a major aspect of one of the research programs being conducted in osteopathic institutions. It has enjoyed the generous support of the osteopathic profession through the American Osteopathic Association, that of the National Institutes of Health, and of the Office of Naval Research.

In selecting a problem for investigation the researcher must identify the broad general area in which he wishes to work, the areas which adjoin it, the specific portion which he wishes to explore in the area, the relation of that portion to the others, and the kinds of information he wishes to seek. The audience to whom he reports should have the benefit of that preliminary perspective. The first part of this paper is, therefore, devoted to orientation.

Because the recognition of the osteopathic lesion and of its importance to the health of man is a distinctive feature of osteopathic theory and practice, it has, in our opinion, become the unfortunate custom to characterize researches under osteopathic auspices, as researches on "the osteopathic lesion," on "the effects of the osteopathic lesion on" this or that function or structure, or some other variation of the same theme.

We believe that far more than this is required to identify the area and objective of each investigation. In accepting such a designation for a research project one accepts either the reduction of the scope, meaning, and complexity of the lesion to the limits set by the project or one accepts a most unrealistic estimate of what can be accomplished by a human being or group of human beings in a single endeavor—or even in an entire lifetime. Even worse, unless the investigator puts his question to nature explicitly and unequivocably he may receive answers to questions other than those he thinks he is asking.

Since a physician must first locate and diagnose an osteopathic lesion before he can treat it, the term "osteopathic lesion" has, through usage, come to designate, in the minds of many, a rather simple, discrete entity, a thing or structure to which one can point and on which one can place his hand. As so often happens, the designation becomes the thing itself. It seems that the osteopathic lesion is becoming implicitly equated with the palpable *concomitants* of the constellation of complex biologic processes which the lesion truly represents. In our opinion this is scientifically as wrong, misleading, and unproductive as equating glycosuria with diabetes mellitus. It is as dangerous as assuming that the visible part of the iceberg is *the* iceberg.

The osteopathic profession is earning its place in the world of the healing arts through demonstrating that the above-surface manifestation is a sign of, and a participant in, a large, massive, dangerous process going on below, and that forces properly applied to that accessible part may move the *entire* iceberg into warm waters.

Too much research, in our opinion, has been devoted to "proving" the existence of the iceberg.[1] What is required in order that osteopathy may now earn its place in the *scientific* world is the disclosure of the nature of the processes going on below the surface, their origins, the factors that influence them and their relation to the above-surface manifestations.[2] Further clinical advance in this area awaits such disclosure by fundamental research.

The osteopathic lesion—even if through usage it has come to represent only the palpable pathology of the somatic or musculoskeletal tissues—must therefore be viewed as representing the local, somatic factors, concomitants, and manifestations of a highly organized response of the *man as a whole* to the demands, stresses, and insults which are part of his life and to which he is not quite adequate. These include most especially the stresses of gravitational origin to which

*Based in part on papers read at the General Sessions, Fifty-Eighth Annual Convention of the American Osteopathic Association, Toronto, Canada, July 14, 1954.

man's musculoskeletal system is especially subject. This response involves the interaction of many processes going on in many tissues, mediated through the nervous and circulatory systems and being continually changed with time, circumstances, activity, and all the factors operating in the individual's life. This is the part of the iceberg lying below the surface. There is no doubt of its immense complexity. Here, unlike the nonliving iceberg, there is not the rigid fixity of relationship between the conspicuous and inconspicuous components — with respect to quantity, importance, origins, history, or even location.

Faced with such a vast and deep problem the investigator must carefully select and equally carefully define an aspect of the total and the kinds of information he seeks within that aspect. He must avoid the danger of identifying the aspect which occupies *him* as *the* osteopathic lesion. The study, for example, of vertebral strain or other somatic components is not synonymous with the study of the osteopathic lesion. To assume so is to destrow its very meaning and to predetermine a blind-alley investigation. From the very moment that the vertebral strain begins, the entire body is already organizing its responses, and from that moment on the insult and the response have no separate existence.

THE AREA OF INVESTIGATION

The laboratory investigations at Kirksville have been directed at an understanding of the role of the nervous system in organizing that response at the segmental level. The program of the Department of Physiology has been concerned especially with the mechanisms, patterns and pathways of interchange between the somatic and autonomic divisions of the nervous system.

While not specifically on "the osteopathic lesion," these are studies of factors and mechanisms intrinsic to it. Furthermore, as will be shown, "physiologic lesions" have been demonstrated in these studies which are closely related, by nature and location, to the phenomena clinically identified as osteopathic lesions by the osteopathic physician.

These investigations are still very young, and they have but scratched the surface. Perhaps their main contribution has been not so much the new information which has been yielded, but that through that information and through relating it to other previously explored areas, it has become possible to restate some old basic osteopathic problems in such a way that for the first time they become approachable by experimental methods. In the time that is available for this research report we cannot possibly summarize 8 years of research but we can show our general strategy, the direction in which we are probing, a few of the *kinds* of information we have found, a few tentative generalizations, and finally our interpretation of the clinical significance of these findings as we see them now.

The strategy of our approach to this aspect of the general problem took its origin in the clinical observations of thousands of osteopathic physicians over a period of several decades. Two main generalizations established the point of departure and direction of our investigation.

1. The signs and symptoms associated with the osteopathic lesion include (a) the presence of tenderness, spontaneous pain or both; (b) altered functions and activities of the associated muscles; (c) vasomotor, sudomotor, and, frequently, visceral changes. In short, they include disturbances in a basic triad of nervous functions—sensory, motor, and autonomic.† Our studies are concerned with alterations of these functions, their interrelations, and their association with other features at the segmental level.

2. Every osteopathic lesion had its origin and development in the context of the life and activities of the individual in whom it is found. The lesion, therefore, with its associated sensory, motor, and autonomic disturbances, has meaning and is interpretable only in that context. We have studied these disturbances (and their experimental modification) in their natural "habitat"—in the voluntary subjects and patients in whom they are found. (Although certain aspects and features of the osteopathic lesion and related phenomena may be experimentally simulated in animals, conclusions drawn from such studies are applicable to the naturally occurring lesion in man only to the extent that their basic similarity to the naturally occurring phenomena can be demonstrated.)

In order to study the triad of nervous functions in man it has been necessary to develop, adapt, and apply methods which would yield reliable information regarding activities in regional or segmental sensory, motor, and autonomic pathways, which would do so without altering those activities and without disturbance of the human subject himself, and which would make possible a comparison of the activities in disturbed areas with those in the normal.

With these methods and with others in continual process of development it became possible to begin the uncovering of what we have called a physiologic mosaic —the related patterns of variations in sensory, motor, and autonomic activity in the various segments.[3] From the patterns in each of these three, from their relations to each other, and from their responses to experimentally induced or spontaneously occurring variables it is becoming possible to deduce the nature of the processes which organize those patterns. The details of those processes and the precise mechanisms, the patterns, and pathways of interchange between the somatic and autonomic divisions of the nervous system can be studied, of course, only in experimental animals, in which the involved parts of the nervous system can be exposed and directly explored by electrophysiologic recording of impulses and by other methods. Such experiments are now in progress.

PREVIOUS STUDIES IN THIS AREA

Investigations conducted at the Kirksville College have indicated that the musculoskeletal stress initiates, or is associated with, unbalanced streams of impulses entering the central nervous system, and that these have the effect of upsetting the delicate balance of that part of the nervous system with which the lesioned part is most directly connected. This was first demonstrated for the muscular or motor component by Denslow and his colleagues in the early 1940's.[4-6] He demonstrated that the segments which are in lesion, as determined by subjective clinical criteria commonly utilized by him and many other osteopathic physicians (tissue-texture abnormality and deep hyperalgesia), were objectively distinguishable by physiologic criteria of motor activity.

Segmental motor reflex thresholds were determined by measuring, in kilograms, the amount of

†A virtually unexplored field exists in a fourth category of nervous function—the so-called trophic functions. Exploration in this field awaits the development and application of satisfactory methods for the study of the slow, long-term influences of peripheral nerve fibers upon the tissues which they innervate, in contrast to the faster, recordable, impulse-transmitted influences. The trophic functions of nerve unquestionably have a very important bearing on the phenomena with which osteopathic physicians deal. They are a rich field for exploration by physiologists, biochemists, pathologists, and others.

pressure applied to the spinous process of each segment which just evokes contraction of the paravertebral muscles at that segmental level. Muscular contractions were detected and evaluated by electromyographic recording. Lesioned segments invariably required weaker stimuli than did nonlesioned segments. The lesioned segment was therefore said to be characterized by lowered motor reflex thresholds—the more severe the lesion the lower the threshold.

In a later study, Denslow, Korr, and Krems[7] demonstrated that diffuse and remote stimuli, including those from the higher centers, and stimuli that occur in normal life, preferentially excited the pathways to paravertebral muscles of the lesioned segments. Responses occurred in these segments, to impulses from many sources, while at the same time nonlesioned segments remained quiescent. Under conditions in which there was generalized muscular contraction the activity in the lesioned segments was relatively exaggerated. The easier opening of the motor pathways in lesioned segments suggested that this was a sustained form of the phenomenon of facilitation under study in numerous neurophysiologic laboratories and that, like the experimentally induced form, it too had its origin in a sustained afferent bombardment by impulses from some segmentally located source.

In the next few years the Department of Physiology adduced a large body of experimental evidence that segmental pathways mediating the other two members of the triad of nervous functions, namely the sensory and the autonomic, might also be maintained in a state of hyperirritability and hyperactivity.[8-11] The sensory components were evaluated through measurement of cutaneous pain thresholds in various dermatomes and through mapping areas of cutaneous and deep hyperesthesia. The autonomic component, limited in these studies to the sympathetic division because of its segmental distribution, has been evaluated through measurement of the activities of the sweat glands and blood vessels of the skin. That is, these cutaneous structures served as physiologic indicators of the activity of the sympathetic outflow to the corresponding areas or segments.

Evidence for hyperirritability of sensory pathways was found in the presence, in most subjects, of persistent areas of lowered pain threshold and of tenderness.[11] For the testing of sweat gland activity we turned at first to the measurement of the electrical resistance of the skin.[8] Skin resistance had been shown by others to be lowered by sweat secretion and elevated in its absence. (See Reference 12 for references.) The possibility of local or segmental hyperirritable sympathetic pathways was first suggested by the finding of areas with consistently low electrical skin resistance in most subjects, even under cool resting conditions, when sweat gland activity was generally absent. It was also suggested by the related and persistent areas of relatively cool skin and other signs of high vascular tone.[11]

AN ILLUSTRATIVE CASE

The kinds of patterns with which we are concerned, and their interrelationships, will be illustrated on a single subject. This patient, whose clinical status is not relevant to this purpose, was explored with the various methods over a period of many months during which time the patterns remained remarkably constant. A sample of each of the kinds of patterns is shown in Figures 1-4.

Figure 1 is a diagrammatic representation of the distribution and relative severity of osteopathic lesion pathology as determined in a palpatory examination by Dr. Denslow. Especially conspicuous are the severe lesions in the lumbrosacral bilaterally; the lumbar area, especially on the right side; and the mid-thoracic levels on the right side. The cervical lesions will be disregarded for this purpose because the physiologic tests were limited to the thoracic, lumbar, and upper sacral segments.

The presence of a sensory component in relation to this lesion pathology was manifest in the deep hyper-

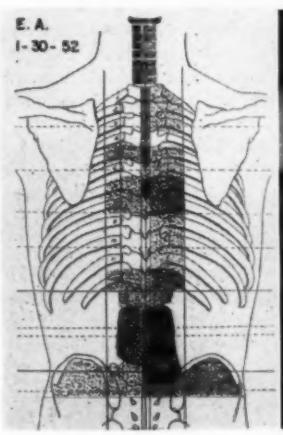


Fig. 1

Fig. 2

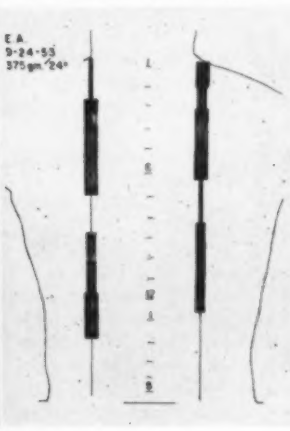


Fig. 3

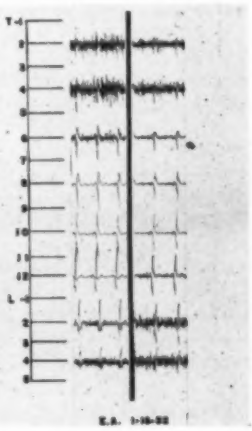


Fig. 4

Figs. 1-4. A Comparison of Segmental Patterns in the Same Subject.

Fig. 1. *Lesion Pathology.*—Diagrammatic representation of the distribution and relative severity of osteopathic lesion pathology as determined by palpatory examination. Fig. 2. *Electrical Skin Resistance (ESR).*—Skin resistance obtained with the photographic recording dermohmeter. Dark areas correspond to areas of low skin resistance on the subject's back. The resistance of these areas is less than 5 per cent of the high-resistance (white) areas. The light spots in the mid-line mark the tips of the spinous processes. Fig. 3. *Cutaneous Vascular Responses.*—Diagram showing the relative intensity and persistence of the red response to standardized mechanical stimulation in different regions on left and right sides of the back. The thin lines represent feeble and short-duration responses in corresponding strips of skin. Evidence discussed later indicates high vascular tone in these areas. Fig. 4. *Activity of the Spinal Extensor Muscles.*—Simultaneous electromyographic activity of the spinal extensor muscles at the segmental levels recorded while the subject is standing quietly.

esthesia present in the same areas. Measurements by the thermal radiation method[13] in our laboratories showed lowered cutaneous pain thresholds in essentially the same areas.

Figure 2 shows the electrical skin resistance (ESR) pattern of this subject as photographically recorded with an early model of the automatic dermohmeter developed in our laboratories.[14] The darkened areas on the photograph represent the location on the subject of low-resistance areas of skin, whose resistance is less than 1/20 that of the normal, high-resistance areas, which are unshaded in this photograph. As an indication of the sensitivity of the method the white areas in this chart indicate resistances of 20,000,000 ohms or more, the black areas, 100,000 or less. The similarity in regional distribution between the low-resistance areas and the clinically determined areas of lesion pathology is to be noted.

Evidence for segmentally related differences in vasomotor tone is shown in Figure 3. This is a diagrammatic representation of the red responses of the paraspinal skin on both sides to standardized mechanical stroking to be discussed later. The thin lines represent strips of skin in which the red, vasodilatation response was weak, suggesting sustained vasospasm in these areas. Certainly the asymmetries in skin temperature which we have repeatedly observed and in vascular response between right and left side of the same segments suggested disturbed vasomotor activity in these areas.

Figure 4 represents an electromyographic study of the simultaneous activity of the paravertebral musculature in this subject at the various segmental levels during quiet standing. The asymmetrical and exaggerated muscular contraction to be noted in the lumbar and upper and midthoracic levels indicates hyperactivity of segmental motor pathways at these levels.

This study was selected out of hundreds not because it is typical, but because of the unusually high degree of *topographic* relationships among the sensory, autonomic, and motor patterns and their relation to the lesion pattern, which greatly simplify the presentation of the principles involved. The topographic relationships between cutaneous (autonomic and sensory) features and the myofascial may not always be expected to be so close because of the differences in peripheral distribution of nerve supply, even from the same segment, to skin, to muscle, fascia, et cetera.

The case does serve to illustrate some of the kinds of measurements and patterns with which we deal. It also serves to illustrate a generalization which began to emerge from our explorations of large numbers of subjects.[3,11] In the most conspicuously aberrant segments, as indicated by our methods, the deviations have consistently been in such a direction as to indicate increased irritability of at least some representatives of each of the kinds of nerve cells—sensory, motor, and sympathetic—arising in that part of the nervous system.

THE NEXT PROBLEM: THE MEANING OF THE PATTERNS

There can be little doubt that there is increased irritability of the sensory and motor pathways in aberrant segments. The findings of low electrical skin resistance, low skin temperature, and feeble red responses suggest that the same may be true for the sympathetic pathways. This, however, is by no means established by the measurements themselves. The assumption that the measurements reflect differences in neurogenic sweat gland and blood-vessel activity would first need to be proved valid. The existence of hyperirritable or facilitated sympathetic pathways would, of course, have very rich fundamental and clinical implications.

Intriguing indications that such implications could often be attached to the areas of low electrical resistance began to emerge from our explorations of large numbers of subjects, both patients and apparently healthy individuals.[9,10] In a large percentage of patients segmental relations were established between the pathologic organ or structure and the areas of low ESR. Segmental relations between the pathologic tissue and the skin resistance pattern were by no means always clear, but the relations were especially sharp in those entities in which there was a pain component.

Even more exciting implications began to emerge after several years of exploring large numbers of apparently healthy persons including many of our students. In a growing number of such individuals, signs and symptoms of visceral disease (for example, coronary artery disease and peptic ulcer) appeared months and years after the demonstration (or first appearance) of prominent areas of low electrical resistance in dermatomes related to the involved viscera. (Some of these symptom-free subjects who later developed visceral disease had had pre-existing skin resistance patterns resembling those found on patients with similar diseases.) In other subjects symptoms and disease in somatic or visceral structures segmentally related to the low-resistance dermatomes appeared for the first time (or intermittently) following periods of severe stress, such as final examinations, systemic infections, and emotional conflicts.[10]

In still other subjects we were able to demonstrate that new and prominent areas of low electrical skin resistance could be induced experimentally by acute stresses and myofascial irritations and accidentally as a result of trauma.[3,10]

These observations were strong assurance that the persistent area of low electrical resistance, whatever its basis, is a functionally and clinically significant sign and that it marked, at least in some cases, physiologically abnormal and relatively vulnerable segments of the body. These observations, therefore, justified a deeper and more thorough investigation of the basis and meaning of the cutaneous electrical resistance and vascular patterns.

In order to establish whether the low skin resistance, low skin temperature, et cetera truly represent local or segmental facilitation of sympathetic pathways, with all its functional and clinical implications, we needed the answers to the following questions.

1. Do the skin resistance and vascular patterns reflect neurogenic variations in submotor and vasomotor activity?

2. Are the sympathetic pathways to the lesioned or low-resistance areas more easily opened and sustained in activity by stimuli and factors operating in daily life?

3. If these are answered affirmatively, does the local sympatheticotonia extend also to structures other than the sweat glands and cutaneous vessels?

The following two papers, based on recent studies,[15-17] illustrate our investigations of these questions and some of the answers obtained. As so often happens in basic research, in the course of further testing the hypothesis of facilitation, we also learned a great deal more about it and its meaning to the living man. The studies on the sweat glands are discussed in the next paper.

II. Sympathetic Activity in Facilitated Segments: Sudomotor Studies

PRICE E. THOMAS, B.S., D.O.

INTRODUCTION

As indicated in the previous paper one of the aims in our research is to obtain reliable information concerning regional or segmental sympathetic activity in human subjects. The sweat glands are almost ideal indicators of sympathetic activity, being superficial and innervated solely by segmentally distributed fibers of the sympathetic nervous system. A number of investigators[18-21] have advantageously used this circumstance to map the extent of nerve injuries or sympathectomies by heating the patient and observing the areas in which sweat gland activity was absent. Exploring the skin for variations in electrical resistance is a simple and quick way of obtaining this information since observations indicate that a drop in resistance invariably accompanies visible sweat gland activity while the resistance in nonsweating (sympathectomized or denervated) areas remains considerably higher.[22-29]

As previously reported,[8-11,14-16] we have adopted the electrical skin resistance (ESR) method with, however, an important difference in technic. Instead of recording only the presence or absence of sympathetic innervation, we sought a measure of gradations in sympathetic activity in various areas and in the same area at different times. We were especially interested in observing whether activity occurs in some regions while other areas are quiescent. Our explorations, therefore, are conducted under cool, resting conditions in which sweating is not visible. Under such conditions, differences in electrical skin resistance among various areas of the trunk have been observed in most of our subjects. In the previous paper in this symposium reference has been made to the observation that areas of low skin resistance are frequently correlated with disturbances of organs or tissues innervated by the same region of the cord as the involved skin. This definitely suggests that ESR variations may reflect variations in nervous activity. Since, however, no visible sweat gland activity occurs under the conditions of our explorations, it was necessary to investigate the relation between ESR and sweat gland activity. The demonstration of such a relationship would provide evidence that ESR, as we measure it, is a reliable index to sympathetic activity.

The results to be presented are from investigations to ascertain the significance of our ESR patterns by comparing the electrical resistance and sweating responses of low- and high-resistance areas to a variety of experimentally induced stresses.

RELATION OF ESR TO SWEAT GLAND ACTIVITY

The Response of Low Resistance Areas to Thermal Stress.—To compare visible sweating with ESR patterns obtained under cool conditions, a series of experiments was performed in which sweating was promoted by exposing the individual to high environmental temperatures. Sweating was made visible by using the color reaction of starch and iodine.[30] Since this reaction occurs only in the presence of moisture, dark spots appear only where moisture has been provided by perspiration. Figure 5 illustrates the results of such an experiment. The ESR pattern of the subject obtained under cool, resting conditions, appears in the upper left-hand illustration (Fig. 5a). Note the distribution of low-resistance areas indicated by dark areas on the chart. The next three pictures (Figs. 5b, 5c, and 5d) show the sequential development of sweating following the entrance into a heated enclosure (45C.). The darkest areas in the pictures are the areas of greatest sweat production. In this and many other subjects, thermally induced sweating began earlier and was greater in low-resistance areas.

The basis for the increased sweat production in the low-resistance areas does not, however, emerge from investigations of this type. These experiments, in fact, served to raise the following questions. Are the area-to-area differences related to anatomic variations in the distribution of glands or to differences in the amount of sympathetic activation of the glands? The answer began to emerge when methods were used which revealed the minute-to-minute relationship between ESR

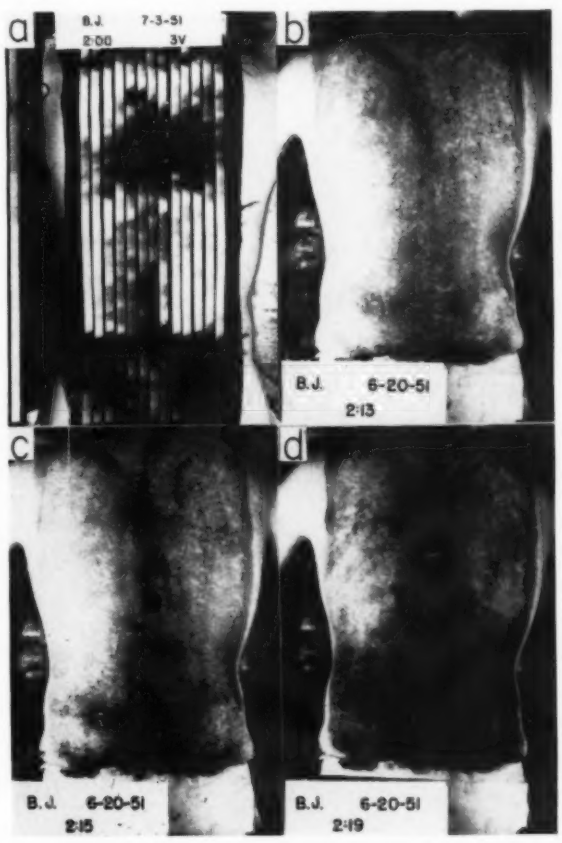


Fig. 5. Relation of Sweat Production to ESR.

Section (a)—ESR exploration done with the photographic dermohmeter. The white areas have a resistance greater than 3,000,000 ohms, the black areas less than 100,000 ohms, with intermediate values indicated by shades of gray. The major low-resistance areas are in the mid-thoracic and lower lumbar regions. Sections (b, c, and d)—Photographs showing the development of sweating following entrance into a heated enclosure (45C.). Sweating areas appear dark due to the color reaction produced by iodine, painted on the skin, reacting with starch powder dusted on the skin.

and the numbers of sweat glands activated in response to a mild thermal stress.

Quantitative Relationship of ESR to Numbers of Active Sweat Glands.—In these experiments the number of sweat glands presenting moisture to the surface from small areas of skin was recorded by counting the spots on starch paper held in contact with iodine-painted skin for 2 minutes.[31] Sweat emerging from the duct of an active gland promotes the reaction of starch and iodine and produces a dark spot on the paper. A fresh piece of paper was used for each 2-minute period; therefore, a continuous record of activity was obtained. The electrical resistance was measured from skin immediately adjacent to the gland-count area. Throughout the procedure the subject was resting in a warm environment (31C.) in which sweating was just perceptible. The results of such an experiment are shown in Figure 6. The upper four lines are the changing gland-counts from small areas of skin at four segmental levels, and the lower four lines show the simultaneous changes in current flow in corresponding areas. For reasons of convenience in charting, current flow is recorded here instead of resistance, and since current flow is inversely proportional to the resistance, the current flow is large when the resistance is low and vice versa.

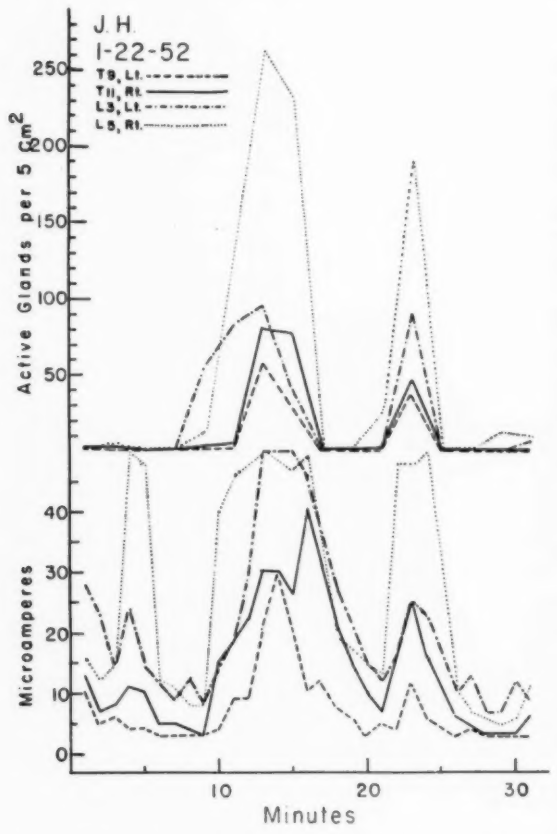


Fig. 6. ESR and Sweat Gland Response to Moderate Thermal Stimuli.

The number of active sweat glands in the four areas was recorded by the Randall iodine-starch paper method. Current flow (inverse of resistance) in each area was measured at 1-minute intervals. Maintenance of room temperature at 31C. provoked the sweat response.

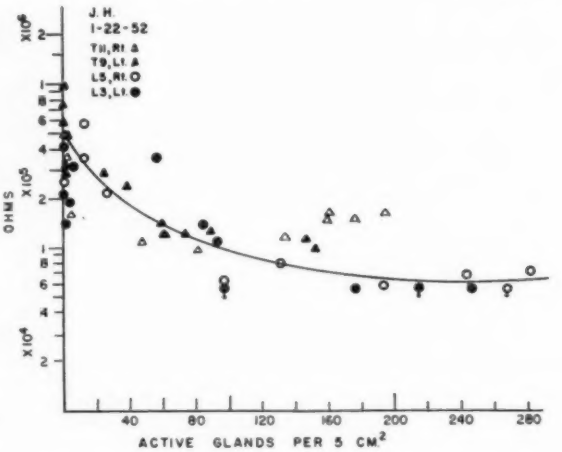


Fig. 7. Relation of ESR to Number of Active Sweat Glands.

From the experimental results shown in Figure 6 the ESR values have been plotted against the gland count at a corresponding time. Only the ESR values obtained at a time when the gland count was increasing have been plotted. This lessens the influence on ESR resulting from moisture remaining in the sweat duct when the gland is not actively secreting.

The graph illustrates the concurrent cyclic variation in sweat gland activity and current flow observed at these moderate temperatures. Peaks of gland activity were accompanied by peaks of current flow. The areas showing the largest rises in current flow (greatest drop in resistance) at a given time were also the areas in which the largest number of glands were active. A graphic plot of the relation between the sweat gland counts and the corresponding ESR measurement is shown in Figure 7. Each point on the graph represents the simultaneous gland-count and resistance observed in a given area. The resistance determines the location of the point on the ordinate and the gland-count the location along the abscissa. From this and other similar experiments it became apparent that over a wide range an increase in sweat gland activity, detectable by this method, was proportional to a decrease in resistance. Under our usual cool exploratory conditions, however, sweating is not detectable by this method although there continue to be variations in resistance. This situation is illustrated on the graph of Figure 7 by the points representing high resistance values that are plotted on the zero gland-count axis.

What, then, accounts for the large variation in resistance we observe under those conditions? It occurred to us that the relationship between ESR and sweat gland activity continues under the cool resting conditions of our explorations, but the sweat gland activity may be at such low rates that the perspiration was evaporating before it could serve as an agent for permitting the starch-iodine reaction. Therefore, experiments were performed using a technic which would reduce evaporation and permit visualization of any differences in low levels of sweat production between high- and low-resistance areas.

Relation of Sweat Gland Activity to ESR at Cool Temperatures.—The method employed consists of staining the skin with iodine and then covering this area with a starch-castor oil mixture.[32] The thin oily film markedly reduces evaporation. In the presence of extremely minute amounts of moisture (0.00005

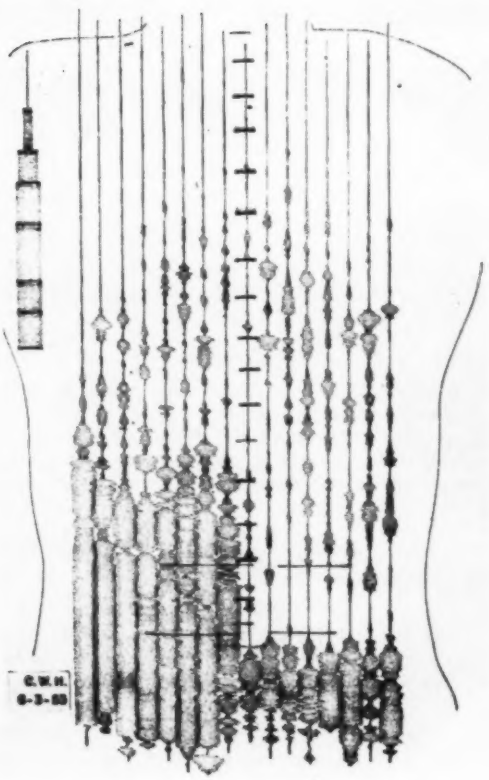


Fig. 8. ESR Exploration of Subject C.W.H.

This record was made with the exploring pantographic dermohmeter. The lower the resistance the larger the oscillation (line appears wider). Segmental areas of marked asymmetry in resistance between left and right from the third to the fifth lumbar vertebra were chosen for experiments presented in Figures 9 and 10.

mg.) the iodine and starch will react to produce a dark spot. The reactions in the area are recorded photographically. The results obtained with this method and their relation to ESR are illustrated in the following experiment.

Figure 8 shows the ESR pattern of subject C.W.H. done at cool temperatures (24C.). This exploration was done with the pantographic dermohmeter, developed in our laboratories as an improvement of the photographic type, and shows the low-resistance areas as wide-amplitude lines. The marked asymmetry in resistance between the left and right sides from third to fifth lumbar segments was very characteristic for this subject, having been present, at this time, for over 8 months. The right and left areas identified by horizontal lines were chosen for testing. Immediately following the ESR exploration, the areas were prepared with the iodine and starch-castor oil mixture, and a photograph of both areas was taken. This portion of the experiment, therefore, yields information on the activity of sweat glands at cool temperatures. This same experiment was then continued while sweating was induced by local heating. The site and method of heating appear to have little influence on results. In this particular experiment heat was applied to the abdomen by an electric hot pad, and for a period of 25 minutes a series of pictures was taken showing the development of sweating in both right and left areas.

Figure 9 contains a series of photographic enlargements showing a 1-cm. strip of skin in each area. Figure 9a, photographs 1-6, shows the series for the right, high-resistance area; Figure 9b, photographs 1-6, shows the corresponding series of the left, low-resistance area. In the preheating photograph 1 of Figure 9b, sweat spots were already present in the left, low-resistance area, but none appeared in the right, high-resistance area until photograph 4 of Figure 9a, taken approximately 13 minutes after the application of heat. The low-resistance area shows a large and rapid increase in the number of dark spots soon after heating.

It appears, therefore, that sweat glands can be active at such low levels that evaporation occurs before the perspiration emerges from the duct. Sweat glands demonstrating this activity are present in skin areas showing low electrical resistances. Thus the low-resistance areas observed under cool conditions appear to be regions where the sympathetic pathways are maintaining a low level of sweat gland activity when there is no generalized demand for sweating.

This experiment also answers the question of whether the low resistance and excess regional sweating may be a result of anatomic differences in the number of sweat glands in a given area of skin. Gland counts from photographs 6 of both Figures 9a and 9b, at which time sweating had become profuse, showed that approximately the same number of glands were

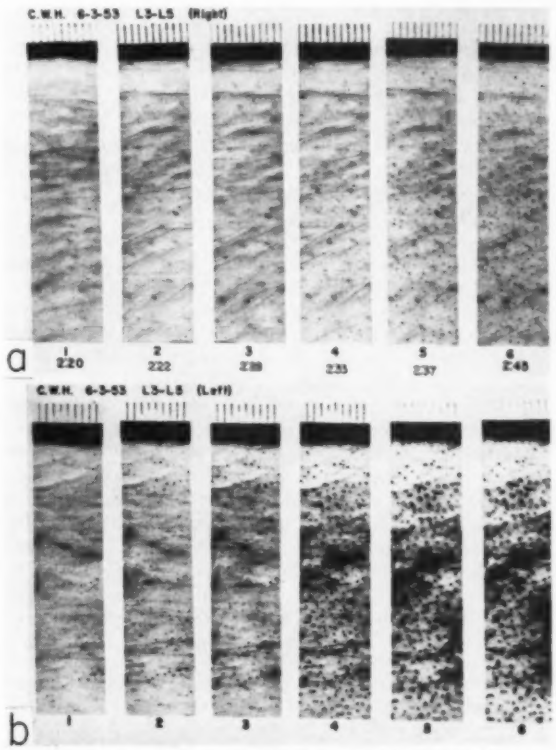


Fig. 9. Comparison of Sweating in High- and Low-Resistance Areas.

Figure 9a. Photographs 1-6 are enlargements showing a 1-centimeter strip of skin from the right area. Figure 9b. Photographs 1-6 are from the left area identified in Figure 8. The sweat gland activity was made visible by the Wada method (described in text). Photographs numbered 1 were taken before and subsequent photographs 2-6 during heating of the abdomen with an electric hot pad. Further explanations are included in text.

eventually activated in both high- and low-resistance areas. The darker appearance of the low-resistance area in photograph 6 of Figure 9b is due to the larger size of the spots, the larger spots resulting from more active secretion by individual glands during the time of the experiment.

These experiments provide evidence that gradations in ESR under cool conditions do reflect gradations in activity of the sympathetic nervous system. The rapid and exaggerated response of low-resistance areas to thermal stimuli, furthermore, indicates that the sympathetic pathways supplying the sweat glands in that area are in a state of facilitation. Is this facilitation, however, confined to thermoregulatory pathways and thus specific only for those stimuli which require heat loss by evaporation, or is there facilitation of responses to other types of stimuli? The following experimental results indicate that the sudomotor pathways in facilitated segments are easily opened by a variety of stimuli.

Responses to Pain and Other Stimuli.—Subject C.W.H. was tested again, using the same areas as in the previous experiment. Sympathetic activation of the sweat glands was recorded electrically. Figure 10 shows the record obtained when pain stimuli were employed. The lines on the graph are the values for current flow, the upper line through the low-resistance area on the left, and the lower line through the high-resistance area on the right. Increases in current flow reflect increases in sweat gland activity. Twenty seconds after the record began a mild pin prick was administered to the right leg, and following a latency of 40 seconds a sharp increase in sweat gland activity occurred on the left, but very little change on the right. At 58 seconds a more severe pin prick was administered. Again after a latency of approximately 40 seconds there was a second sharp increase in activity on the left, but still only a very moderate change on the right. The sympathetic fibers supplying the sweat glands in the low-resistance area, therefore, do show hyperactive responses to remote or generalized pain stimuli. Many other stimuli have also been found effective in producing an exaggerated sweat-gland response from the low-resistance areas including stimuli such as the threat of pain, being startled by unexpected events, apprehension, discomfort, and postural stresses.

The evidence presented indicates that, under cool conditions, the presence of low-resistance areas is a reflection of facilitated portions of the sympathetic outflow as demonstrated by continuous activity and exaggerated responses to a variety of stimuli. The response to stimuli from many sources suggests that the factor or factors responsible for the facilitation may exert their influence within the region of the spinal cord from which these sympathetic fibers have their origin. The identification of the source or sources of this facilitating influence is part of the current and future investigations of our laboratory.

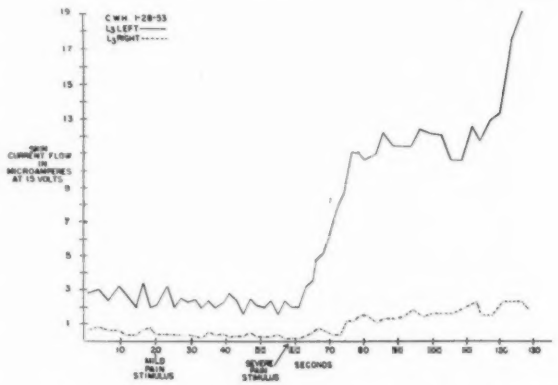


Fig. 10. Comparison of Response to Pain in High- and Low-Resistance Areas.

Sweat gland activity was recorded by intermittent measurements of current flow in the two areas identified in Figure 8. Each pain stimulus consisted of a single pinprick to the calf of the right leg.

SUMMARY

1. It has been clearly demonstrated that ESR reflects sweat gland activity and that variations in ESR are related to variations in the number of active sweat glands.

2. The variations in active sweat glands reflect variations in sympathetic activity, and, therefore, ESR is a reliable index to sympathetic activity.

3. The simultaneous responses of low- and high-resistance areas have been examined.

4. Low-resistance areas are those in which sweat gland activity is present under conditions in which there is no such activity elsewhere on the trunk.

5. The sympathetic (sudomotor) pathways represented by low-resistance areas show exaggerated and easily elicited responses to a variety of experimental stimuli.

6. Areas of low electrical skin resistance, observed under cool, resting conditions, therefore, appear to represent a facilitated portion of the sympathetic nervous system.

7. This suggests that the tissues innervated from the facilitated segments may, under the stresses of daily life, be exposed to sustained and excessive sympathetic stimulation.

Evidence that this facilitation involves sympathetic fibers to structures other than sweat glands is presented in the following paper of this symposium.

III. Sympathetic Activity in Facilitated Segments: Vasomotor Studies

HARRY M. WRIGHT, D.O.

INTRODUCTION

The importance of the normal circulation to all body tissues and organs in the maintenance of their optimal functional activities has long been appreciated by all physicians. This concept has been further substantiated in recent years by an increasing body of evidence which indicates that neurogenic vasospastic states may initiate or contribute to many clinical syndromes.[33-38]

It is now also well known that the sympathetic division of the autonomic nervous system plays an important role in regulating the vasomotor tone and thus the blood supply to most, if not all, tissues.[39-41] One might ask therefore, if the facilitatory process affecting the sensory, motor, and sympathetic sudomotor pathways, previously described in this symposium, affects also the vasomotor pathways. If so, a relationship might exist between aberrant sympathetic vasomotor activity and the initiation or perpetuation of many pathologic entities. The investigation of this problem represents an important phase of our research program.

SKIN TEMPERATURE PATTERNS

The skin temperature patterns obtained in exploration of a large number of subjects suggested that variations in vasomotor tone along the trunk might exist. Systematic mapping of the segment-to-segment skin temperatures under constant environmental conditions revealed the presence in each subject of local areas which were consistently hypothermic or consistently hyperthermic relative to adjacent or contralateral symmetrical areas.

To illustrate, the skin temperature graphs of two subjects obtained at intervals of several months are compared in Figure 11. Note that the distribution of the hypothermic and hyperthermic areas is constant and characteristic for each subject; however, the thermal patterns of the two subjects differ markedly. This was found to be true in a large number of subjects, each with a pattern highly characteristic of and identifiable with that individual.

In many subjects the areas of hypothermia appear to correlate with areas of low skin resistance, as well as with sensory and motor deviations. This further suggested that differences in the skin temperatures along the vertebral column might reflect differences in vasomotor tone.

However, the multiplicity of factors (such as the thickness of the skin, the underlying fat layers, the activity of the underlying muscles, the evaporation of moisture) which influence skin temperature[42-46] renders it difficult to interpret with respect to the local circulation and unreliable for comparing one area with another. This made necessary the development of a more direct method for the evaluation of peripheral vascular responses and tone.

METHODS OF INVESTIGATING VASOMOTION

Plethysmography, that is, the measurement of volume changes in an organ or extremity,[47] is a method that has been extensively utilized in studying peripheral vascular responses and peripheral vascular diseases.[48] However, the mechanical plethysmograph obviously could not be used for the study of the cutaneous vascular responses on the trunk.

Photoelectric plethysmography[49-53] is also a useful method in evaluating local circulatory changes but, again, unsatisfactory for comparing different areas on the trunk or for exploratory technics.

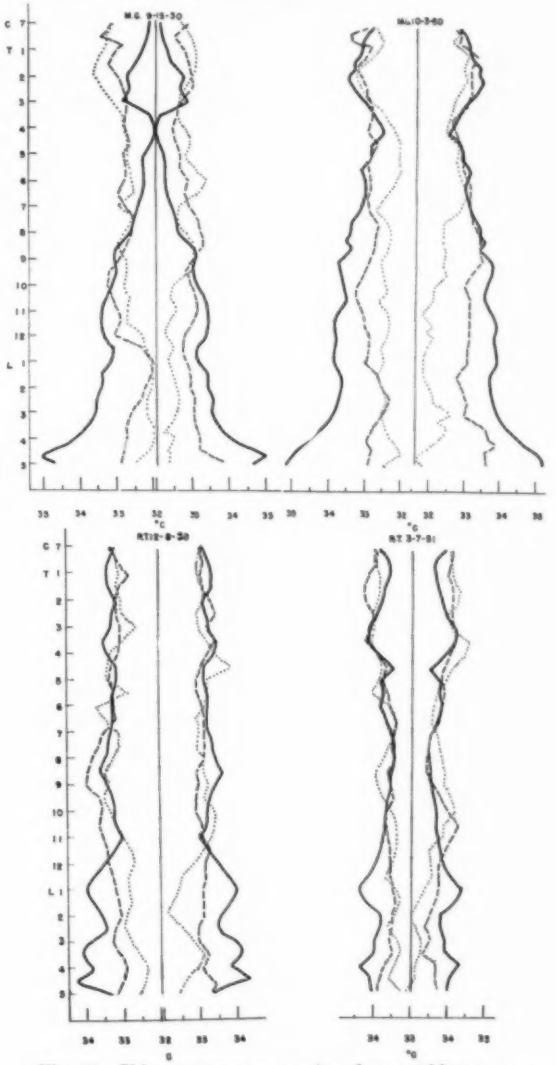


Fig. 11. Skin temperature graphs of two subjects.

Graphs illustrate constancy of distribution of hypothermic and hyperthermic areas on the trunk and characteristic differences between the thermal graphs of the two subjects.

Temperatures along each of five longitudinal strips of skin are here related to the segmental level. The - - - - - lines represent the temperatures 1½ inches lateral to the vertebral column, right and left; the . . . . . lines 3 inches lateral on each side. The mid-line temperatures are drawn as a symmetrical pair of solid lines. The "indentations" represent hypothermic areas; the "bulges" represent hyperthermic areas. The thermal "patterns" of the two subjects differ markedly. However, the distribution of the "warm" and "cool" areas in each subject appears constant over a period of several weeks, which suggests regional or segmental variations in the vasomotor tone of the cutaneous vasculature.

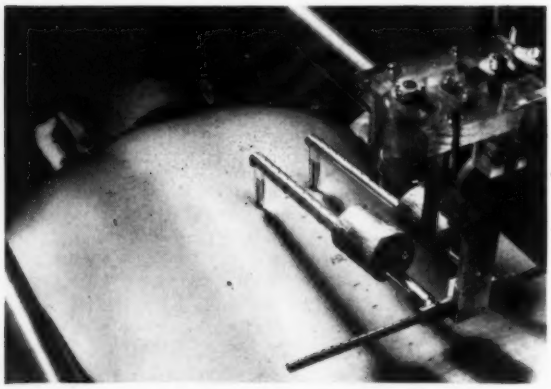


Fig. 12. Mechanical "Skin Stroker" for Study of the Red Response.

A constant speed motor draws the rounded wire applicators in a straight path along the test area down the back at 4.5 cm. per second. The intensity of the stimulus can be varied by changing the position of the weights on the lever arms from 150 to 500 grams in 25-gram steps. A constant stimulus of sufficient intensity is applied to elicit some degree of the red response at all levels from the first thoracic to the sacrum. Daylight fluorescent bulbs facilitate observation of the response.

Capillaroscopy has been extensively utilized in studying the capillary reactions both experimentally[54-55] and in pathologic syndromes[56-59] in certain areas such as the nail bed, but this technic is also unsuitable for studying the capillaries of the skin of the trunk. Indeed, the literature reveals little evidence of systematic investigation of the segmental or regional vascular reactions on the trunk, no doubt largely because of the problems of methodology.

The first major problem in studying vasomotor activity on the trunk was, therefore, the development of a suitable method. The most satisfactory approach appeared to be that of studying the vascular responses to various types of stimuli, such as chemical, electrical, mechanical, and thermal. Of these, we found the response to mechanical friction the most promising and practicable.‡ An adaptation of the mechanical stimulation technic extensively used by Di Palma[60-61] for the study of the reactivity of blood vessels was developed and has proved very useful. In this method the skin of the trunk is stimulated by mechanical friction and the vasodilating response of the cutaneous vessels—the red response[62]—is observed and evaluated.[17]

An instrument, the mechanical skin stroker (Fig. 12), was designed and constructed for the application of standardized frictional stimuli to the skin of the back. A stimulus consists of drawing a rounded wire stimulator at a constant speed over the area of skin to be tested. The intensity of the stimulus can be varied from 150 to 500 grams by changing the position of the weight on the lever arm of the instrument. The intensity of the stimulus necessary to elicit a red response (threshold stimulus) differs from area to area in the same subject, and from subject to subject. However, instead of attempting to measure thresholds of vasodilatation, comparative intensity and duration of the responses to uniform stimuli were studied. To do this, a constant stimulus of sufficient intensity to elicit some degree of the red response from all areas is applied to a longitudinal strip of skin extending from the first thoracic vertebra to the sacrum in each test. Those areas in which the red response is most intense (low threshold for vasodilatation) are the same areas in which the response persists for the longest period. Areas in which the red response is weak (high threshold for vasodilatation) also fade quickly. For comparison of symmetrical bilateral test areas, two stimulators may be drawn down the back simultaneously at equal distances from the vertebral midline.

RED RESPONSE PATTERNS

We have found it convenient to refer to the patterns of intensity and persistence of the red responses

‡It was brought to our attention by Dr. George W. Northup that the red response has been used in clinical practice and osteopathic diagnosis by himself and other individuals. To elicit the red response, the index and middle fingers are firmly passed down the back straddling the vertebral column. The intensity, duration and other characteristics of the erythema elicited by this frictional stimulus are then observed.

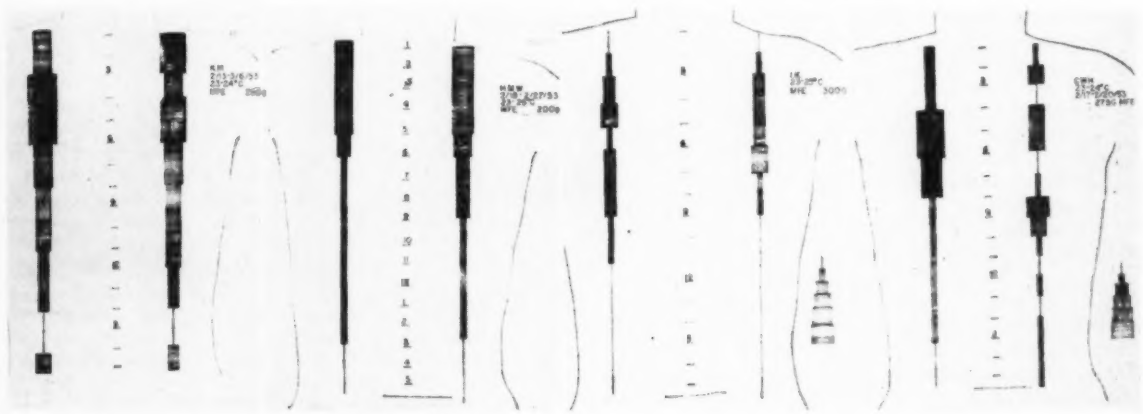


Fig. 13. Red Response "Patterns" of Four Subjects.

The calibrator of the pantographic dermohmeter is utilized in charting the red responses. The thickness of the lines is related to the intensity and persistence of the red responses at each vertebral level—the thicker the line, the more intense and persistent the response. Thin lines thus indicate areas which have a high threshold to vasodilatation (high vasomotor tone) and in which the response fades in approximately 30 seconds. Thick lines indicate areas of low threshold to vasodilatation (low vasomotor tone); in these areas responses may persist for 5 minutes or longer. Note that subjects differ with respect to intensity of stimulus necessary to elicit the red response, and the frequent *asymmetries* in response between the right and left sides in each subject (except K.M.). Regional and segmental differences in the red response suggest regional and segmental differences in vasomotor tone.

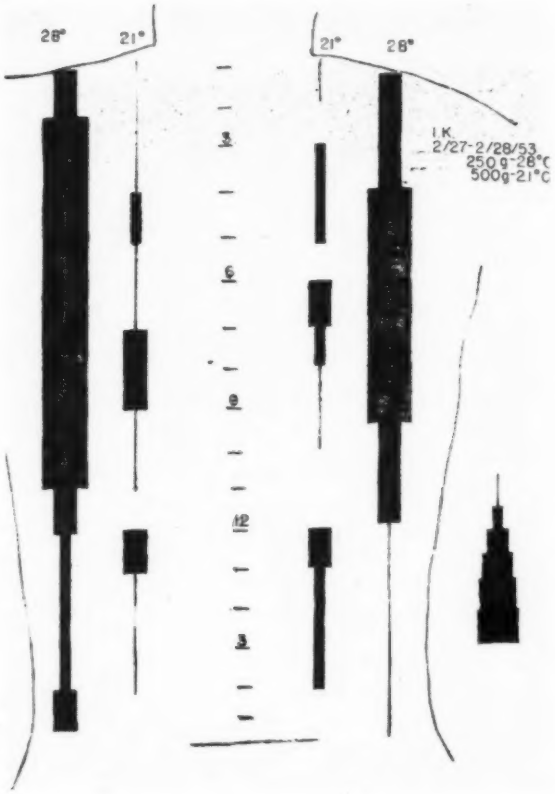


Fig. 14. Effects of Warm and Cool Ambient Temperatures on Red Response.

This chart compares the red responses of a subject at ambient temperatures of 21C. and 28C. (Method of charting is the same as described for Figure 13. The responses from the same locus of stimulation are here recorded on one body chart for convenience of comparison.) The central pair of lines records the intensity and persistence of the red responses at 21C., the lateral pair at 28C. At 21C. (high vasomotor tone) the response is weak or absent following a 500-gram (strong) stimulus; at 28C. (low vasomotor tone) the response is intense and persistent after a 250-gram (weak) stimulus. The variation in the red response with (temperature-influenced) variations in vasomotor tone suggests that segmental and regional variations in the red response may also reflect variations in vasomotor tone.

(erythema) resulting from standardized frictional stimuli as "red response patterns."

Figure 13 shows the red response patterns of four subjects. In these charts the intensity and persistence of the responses in the test area is indicated by variation in thickness of the lines at the corresponding vertebral levels. The thicker the line, the more intense and persistent the response. Thin lines thus indicate areas refractory to vasodilatation in which the response was weak and faded quickly, that is, in approximately 30 seconds. The most persistent red responses may last 5 minutes or longer.

The typical red response repeatedly observed on subject K. M. is seen in Figure 13a. His responsive and refractory areas have a relatively symmetrical distribution. In all subjects observed the lumbar region was much less responsive to vasodilatation than the thoracic area, indicating a basic regional difference which has been previously reported by Di Palma and Foster.[63]

Figure 13b shows the red response pattern repeatedly observed on another subject. The responses of this subject were elicited with a weaker stimulus, 200 grams. Although this subject's responses were most intense in the upper thoracic levels, the left side responded less intensely than the right, with a refractory area from the sixth to ninth thoracic vertebrae on the left as compared with the same area on the right side.

The subject whose pattern is shown in Figure 13c required a much stronger stimulus, 300 grams, to elicit the red response in all areas. In this subject, in contrast to the previous one, the upper thoracic levels were refractory to dilatation. Note the asymmetries between the right and left sides and the highly refractory areas at the fifth and sixth thoracic segments on the left, and the seventh to ninth thoracic on the right.

Quite a different pattern is seen in Figure 13d. Marked asymmetries occurred between the left and right sides extending from the first to tenth thoracic segments with highly refractory areas at the third to fourth and the sixth to seventh segments on the right.

SIGNIFICANCE OF VARIATIONS IN THE RED RESPONSE

What do segmental or regional differences in the red response represent? In order to test the possibility that segmental or regional differences in the red response might represent segmental or regional differences in vasomotor tone, we performed the following experiment.

It is well known that warm temperatures cause a decrease in cutaneous vasomotor tone (dilatation), while cool temperatures cause an increase in vasomotor tone (constriction). We therefore exposed individuals to ambient temperatures that are known to increase or decrease vasomotor tone and observed the effect on the red responses. The red responses of the same subject and from the same area of stimulation were observed at ambient temperatures of 21C. and 28C. They are compared in Figure 14. Note that the intensity and persistence of the red responses were *increased* by the warm temperature, which decreases vasomotor tone, and *decreased* by the cool temperature, which increases vasomotor tone. At the lower temperature (which increases vasomotor tone), the responses were weak or absent following even very strong stimulation, while at the warm temperature of 28C. (which decreases vasomotor tone) relatively weak stimuli elicited intense responses. This experiment shows, therefore, that ambient temperatures that are known to affect vasomotor tone also affect the red response. This suggests that the segment-to-segment differences in the red response at constant ambient temperature may also be related to differences in vasomotor tone existing between areas of the skin at various segmental levels and on the right and left sides at the same level.

FUNCTIONAL SIGNIFICANCE OF VARIATIONS IN THE RED RESPONSES

Do areas that differ in their red responses differ also in their functional response to stresses normally encountered in daily life? The experimental results recorded in Figure 15 show the simultaneous vasomotor responses to a change in posture of areas which differ in their red responses.

It has been well established[64,65] that with a change from the prone to the erect posture one of the major circulatory adjustments is a peripheral vasoconstriction causing a decrease in skin temperature which is greatest in the more caudal areas from the heart (feet, legs, et cetera). We have utilized this normal peripheral

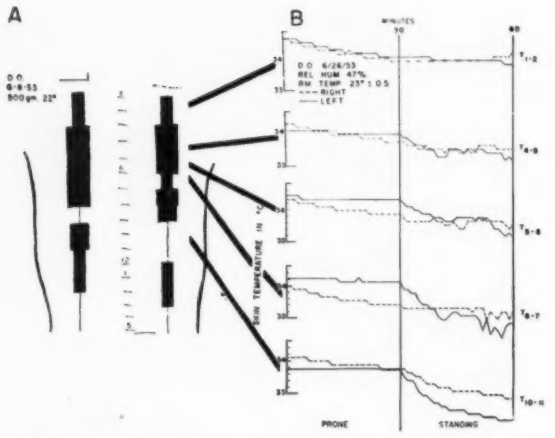
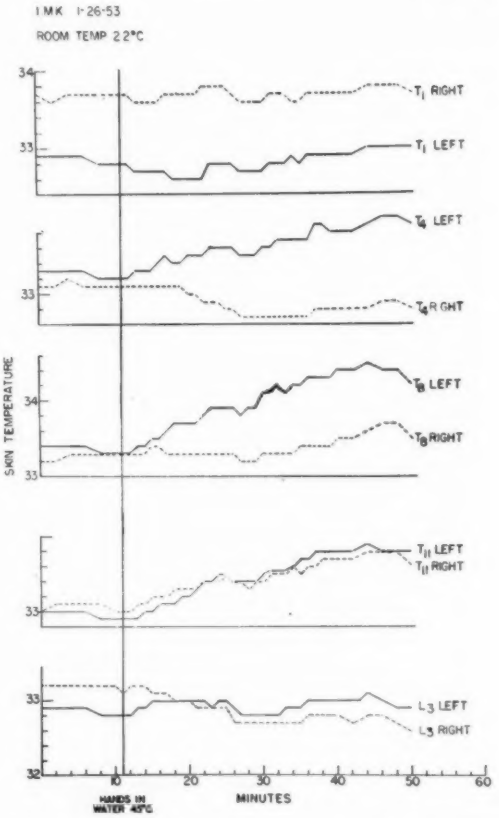


Fig. 15. Functional Response (as Measured by Skin Temperature) of Areas Differing in the Red Response to a Change in Posture.

Chart A shows the relative intensity and persistence of the red responses of subject D.O. Chart B records the changes in skin temperature from the five symmetrically paired areas on the back chosen for testing (indicated by the connecting black lines) when the subject changed from the prone to the erect posture. Note that both the sixth to seventh and tenth to eleventh thoracic levels on the right showed weak red responses (as compared to the left side at the same levels) and also made a diminished contribution to the postural vasomotor adjustment as shown by little or no change in skin temperature with a change in posture. This suggests that these areas are maintained in a chronic state of high vasomotor tone.

vasomotor adjustment to the erect posture in measuring the functional responses of areas that differ in the red response. Chart A of Figure 15 records the relative intensity and persistence of the red responses in a subject at each segmental level on the right and left sides of the vertebral column. Note the asymmetrical responses between the right and left sides. Chart B is the record of the vascular responses in the same subject to a change in posture as measured by changes in skin temperature in five symmetrically paired areas on the back. Note that those levels which were asymmetrical in the red response were also asymmetrical in this response to stress. At each level, the side which showed a relatively weak red response, that is, a refractoriness to vasodilatation, also made a diminished contribution to the postural vasomotor adjustment.

Similar functional differences between areas differing in the red response are also revealed when the subject is exposed to a thermoregulatory stress. The thermoregulatory response (reflex vasodilatation) to heating of the hands[66,67] as measured by changes in skin temperature of five symmetrically paired areas on the trunk at different segmental levels in subject I.M.K. is seen in Figure 16. Note the difference in response between the right and left sides at the fourth and eighth thoracic vertebrae. At the right eighth thoracic the vasodilatation is markedly reduced, while at the right fourth thoracic the vasodilating response is absent; indeed, the response (vasoconstriction) was similar to that ordinarily elicited with painful stimuli. The right sides of both segments were in this subject relatively cool and showed weak red responses.



Feb. 16. The Functional Response to Thermoregulatory Stress.

Response (as measured by skin temperature) of five symmetrically paired areas on the trunk of subject I.K. to the thermoregulatory stress of heating the hands. There is little or no vasodilatation at the fourth and eighth right thoracic levels as indicated by little or no elevation in skin temperature in these areas. This experiment suggests that these areas are maintained in a chronic state of high vasomotor tone.

SUMMARY

1. Studies of the red response of the skin of the trunk reveal patterns of topographic or dermatomal variations in threshold, intensity, and duration.

2. In each subject local areas or dermatomes are found which are highly resistant or refractory to vasodilatation; their distribution is constant and characteristic to a marked degree for each subject.

3. Evidence was presented that the cutaneous vasculature in the areas refractory to dilatation is maintained in a state of exaggerated vasomotor tone or vasoconstriction.

4. These aberrant areas differ physiologically from adjacent or normal areas and respond to stress in an impaired, altered, limited, or exaggerated manner.

5. The frequent correlation of these areas of high tone or vasoconstriction with low skin resistance and other segmental features supports the hypothesis that the central facilitatory mechanism extends to the vasomotor sympathetic pathways and that these pathways are maintained in a state of sustained sympathetic hyperactivity under the stress and stimulation of daily living.

6. This conclusion appears to be in harmony with the observations of Adams-Ray,[33,34,68,69] Doret,[70] Travell,[71,72] Stürup,[73] Delore,[74] and other investigators who have frequently observed pallor or vasospasm and hypothermia in the cutaneous reference zones associated with visceral and myofascial disturbances.

IV. Clinical Significance of the Facilitated State

IRVIN M. KORR, Ph.D.

SUMMARY OF FINDINGS

It appears from studies such as those that have been presented, in which certain sensory, motor, and autonomic characteristics are measured on or near the surface of the body, that:

1. Aberrant segments of the spinal cord occur in most individuals, including apparently healthy persons.

2. These segments are abnormal in their tonic activity and in their responses to various stimuli.

3. In these segments at least some of the neurons mediating sensory, motor, and autonomic function are maintained in a state of hyperexcitability, which they manifest in their easier, augmented, and prolonged responses to impulses reaching them from many sources.

4. They are therefore susceptible to sustained and exaggerated activity under conditions of daily life.

5. The influence normally exerted by these neurons on the tissues which they innervate may thereby be exaggerated.

6. These segmental disturbances appear to be physiologic lesions related, by nature and location, to the clinical phenomena designated as osteopathic lesions.

Since our experiments showed that the pathways through these segments, including those of the sympathetic outflow, were more easily "opened" and sustained in activity, these observations further strengthen and enrich the hypothesis of chronic segmental facilitation thought to be associated with the osteopathic lesion.[8,75,76] What does facilitation mean, functionally and clinically? In general, it means that the tissues innervated from the lesioned segment, and therefore the individual as a whole, are sensitized to all the influences operating within and without the individual.

Facilitation of the *sensory* pathways in the disturbed or lesioned segments means that there is easier access to the nervous system—including the higher centers—through these segments. The lesioned segment is one through which environmental changes—especially noxious or painful stimuli—have exaggerated impact upon the man.

Facilitation of *motor* pathways leads to sustained muscular tensions, exaggerated responses, postural asymmetries, and limited and painful motion. Since the muscles have rich sensory as well as motor innervation, under these conditions they and related tendons, ligaments, joint capsules, et cetera may become sources of relatively intense and unbalanced afferent streams of impulses.

The physiopathologic effects of facilitation of local *sympathetic* pathways depend, of course, on the structures which are innervated by those pathways; that is, *which* viscera, *which* blood vessels, *which* glands. Our studies showed the existence of facilitated sympathetic pathways to the sweat glands and blood vessels in the skin innervated from the disturbed segments and illustrated the effects of such facilitation on their functions and on their responses to impulses arising in various receptors and in the higher integrative and cerebral centers. It is important to determine whether these cutaneous signs are indicative also of facilitation of the sympathetic pathways to other organs, tissues, and blood vessels innervated from the same or related segments.

SIGNIFICANCE OF CUTANEOUS SIGNS OF LOCAL SYMPATHETICOTONIA

Experimental studies designed to clarify this question are now in progress in relation to the kidney. As yet, the evidence, mainly clinical and presumptive, is strong (1) that local sympathetic hyperactivity reflected in the skin may be associated with sympathetic hyperactivity in the viscera, (2) that the cutaneous manifestations are associated with disturbances elsewhere in the segment, and (3) that local sympathetic hyperactivity is an important factor in disease. This evidence will be briefly summarized.

1. As stated in the introductory paper of this symposium, prominent areas of low ESR are often found in dermatomes segmentally related to pathologic viscera. Hyperhidrosis in dermatomes related to pathologic viscera has also been demonstrated by others.[77,78]

2. In a significant percentage of apparently healthy subjects, prominent areas of low ESR marked segments in which overt disease later appeared or which were especially susceptible to disturbances under stressful conditions.

3. Clinical reports are rapidly accumulating in the literature that many serious clinical entities are associated with local autonomic imbalance in the direction of sympatheticotonia (even when the manifestations of the disease are those which would be simulated in experimental animals by parasympathetic stimulation). Symptomatic relief, lasting improvement, and even "cures" have been achieved through surgical, pharmacologic, or other blockades of the sympathetic pathways to the involved organs.[79-88]

4. A number of visceral and other chronic diseases appear to begin as ischemic states of the involved tissues due to local neurogenic vasospasm. This vasospasm seems to be of sympathetic origin and is also associated with vasospasm (pallor, hypothermia) in related segments of skin.[33,34,68-70,89-91]

5. It appears well established through clinical and experimental investigations that the vasomotor responses in skin and in viscera are quite parallel. Stimuli which elicit vasoconstriction in one, commonly do so in the other also.[89,92-96] (This is the pattern, of course, associated with diffuse sympathetic activation, for example, in muscular effort and in certain responses to intense environmental or emotional stimulation, when blood is shunted from viscera and skin to the skeletal muscles.)

It appears certain, therefore, that the facilitation of local sympathetic pathways to the skin, such as that demonstrated in our sweat gland and vascular studies, is commonly part of a generalized sympathetic hyperirritability affecting other tissues innervated from related parts of the nervous system. It appears equally certain that the resultant sustained local sympathetic hyperactivity has considerable clinical significance, many diseases, especially of the chronic degenerative type, being associated with, and perhaps ascribable to, hyperactivity of the sympathetic innervation of the affected organs and of somatic structures reflexly related to them.

Why is the exaggeration of sympathetic influence so dangerous and so frequently an etiologic and contributory factor in disease? Normally, the sympathetic nervous system plays a most important role in organiz-

ing the adaptive and protective adjustment of the body's resources to environmental variations and extremes, to muscular work, to emotional stress, to alarm, et cetera. It suppresses the activity of internal organs not immediately involved in the emergency action and shunts the blood supply from these organs and from the skin to the skeletal muscles. But high levels of sympathetic activity normally occur only intermittently or for relatively brief periods. When, however, such sympatheticotonia—whether local or general—becomes sustained, then the associated reduction in visceral blood flow, inhibition of secretory and smooth-muscle activity, spasm of sphincters, et cetera, eventually result in some damage and dysfunction of the affected organs and in disturbance of the entire body economy.

NATURE, ORIGINS, AND SIGNIFICANCE OF SEGMENTAL SYMPATHETICOTONIA

Our laboratory observations and the many years of clinical observations in osteopathic practice appear not only to have established that the osteopathic lesion represents such a state of local sympatheticotonia, but they also extend our understanding of its nature, origins, and clinical significance.

In the background of the available knowledge, our studies indicate that under conditions of daily life there may be steady streams of impulses flowing out of the facilitated segments through the sympathetic pathways to the structures which they innervate, beyond—or in conflict with—demands made by the homeostatic mechanisms. Under circumstances in which sympathetic activation ordinarily occurs, the "drive" through the facilitated segments is initiated earlier, reaches higher intensities sooner, and is sustained longer than in others. Under conditions of chronic environmental or emotional stress, for example, the deleterious influences will be preferentially focused upon and channelized through the facilitated segments.

The lesioned segment, therefore, is one which is continually in, or bordering on, a state of "alarm"; according to our sudomotor and vasomotor studies, it seems literally to be in a "cold sweat." In such a segment, since the "emergency" sympathetic mechanisms are frequently operating even under "resting" conditions, since they rapidly approach maximum activity under mild stimulation and since they may be maintained near maximum activity by taxing life situations, the margin between resting and maximum levels is narrowed; in short, the physiologic reserve is reduced. As our studies on the skin show, the burden of compensation is thrown on the other segments and organs. The total resources of the individual himself are thus impaired.

Whether or not overt disease develops depends, of course, upon the total resources of the individual and the demands made upon them. The greater the demands made, by the total environment or by the individual himself, in relation to his resources, the greater the invasion of physiologic reserve and the higher the probability that the lesioned, facilitated segment will become the decisive factor limiting the adequacy of those resources; the greater the certainty that the tissues of the facilitated segment will be impaired and damaged by the exaggeration of sensory, motor, and sympathetic influences; the greater the probability that disease will start in, or through, the facilitated segment or in the mechanisms which carry the burden of compensation.

The precise syndromes which may develop from the deleterious influence of sustained sympatheticotonia will, of course, be determined by the primary target organs, which in turn will be determined by the location of the segments which have become facilitated. The same disturbance, therefore, through action upon different tissues, may have a large variety of manifestations.

It is important to recognize also that the manifestations may change with time. For example, certain preliminary observations made by us, which are richly confirmed by observations made by many other investigators, suggest that in the chronic state the peripheral mechanisms may, as it were, "fatigue out"; the hyperhidrosis may give way to hypohidrosis; the vasospasm may give way to vasomotor atonia, with stasis, engorgement, inflammation, edema, et cetera.[37] That is, in the chronic state, when degenerative changes threaten, the initial sympatheticotonia may be masked.

The matter of changes associated with chronicity merits at least brief examination, since some of the manifestations of long-sustained sympathetic hyperactivity are such as to give the unwary physician etiologic and diagnostic clues and, therefore, false guides to therapy. In the chronic state the sustained sympatheticotonia, with its associated ischemia and trophic changes, may have so altered the character of the tissue and its responses to *normal* nervous and hormonal factors as to make it an unreliable indicator of these factors. Excessive sympathetic activity, by increasing the sensitivity or responses of the organ to normal parasympathetic stimulation, may, as in peptic ulcer and other entities, actually simulate parasympathetic hyperactivity (that is, the responses to experimental stimulation of parasympathetic nerves in animals).

Moreover, the evidence is now quite convincing that local sympatheticotonia may actually *produce* parasympathetic disturbances. Two basic mechanisms are indicated: (1) Through (sympathetic) vasomotor fibers controlling blood flow through the parasympathetic cranial and sacral nuclei and parasympathetic nerve trunks, and (2) alteration of the tissues so that the afferent discharges from these tissues to parasympathetic centers will also be altered. Such false and unbalanced "signals" from these tissues will disturb the regulatory parasympathetic reflexes and mask the original sympathetic manifestations. The effects, through both mechanisms, may be so remote, segmentally, from the site of the sympatheticotonia as to obscure the relationship.

Similar relationships apply with respect to the endocrines. Not only does sustained sympatheticotonia alter the responses of tissues to the circulating hormones, but ischemia of any endocrine gland, due to local sympatheticotonia, may produce widespread and remote effects which do not show their primary sympathetic origin.

There is little doubt, therefore, of the serious and protean manifestations of sustained local, regional, or segmental sympatheticotonia. What are its origins? There are fairly acceptable theories offered in the literature to explain generalized sympatheticotonia, as in anxiety states, certain types of hypertension, and hyperthyroidism, and most are based on disturbances of the higher centers, of general metabolism, or of one or more of the endocrine glands. Few satisfactory hypotheses are offered, however, in explanation of the localized sympatheticotonia of a few selected segments of the nervous system. What can our growing knowledge about the osteopathic lesion contribute to our

understanding of the origins of segmental sympathetic-cotonia?

On the basis of available knowledge regarding the related reflex mechanisms it appears that the segmental sympathetic hyperactivity originates as *part* of a highly organized reflex response, organized at the spinal cord level; that the response is set in motion by certain forms of sustained irritation arising in one or more tissues innervated from the corresponding segment; that this afferent irritation facilitates the maintenance and exaggeration of impulse traffic in the sensory, motor, and autonomic pathways which originate in this segment; that such exaggerated traffic may be produced and sustained in these facilitated segmental pathways by impulses reaching the segment from any source. Perhaps because of this neurologic focusing that takes place through the facilitated segment and because of the associated tissue changes and activities, the reflex process, once initiated, sustains itself even long after the *original* facilitating factors may have passed.

The facilitating factors may arise in individual tissues or organs (1) which have been directly subjected to injury, stress, or irritation or (2) to which irritations or excessive and prolonged demands have been directed by the *total response* of the individual to life situations and environmental factors.

Many possible initiators of such local disturbance have been postulated and some of them, certainly, are valid. However, one of osteopathy's major contributions to the biological and medical sciences is the demonstration that factors which evoke the segmental responses arise with very high frequency in the weight-bearing or axial portions of the musculoskeletal system.

THE SOMATIC COMPONENT

Man's musculoskeletal system is an incomplete and imperfect — certainly an unstable — adaptation of a basically quadruped system to biped stance and locomotion. The components of a perfect cantilever bridge have been somewhat rearranged and modified by evolutionary process to form a less adequate skyscraper.[97] There is no doubt that gravity is far more demanding of man's resources than of other mammalian species. As a result, local postural stresses, asymmetries, myofascial tensions and irritations, and articular and periarticular disturbances have a peculiarly high incidence in man. Their probability, always high, increases with time. In man, therefore, gravity has become an environmental factor of great importance to his health.

Man's responses to gravitational factors—the postural and righting reflexes — though adaptations of those inherited from lower-form ancestors, are characteristic of man the species. They are, however, individually modified by many of the factors which distinguish one individual from another and by circumstance. Although foci of musculoskeletal stress or irritation may rise as the direct result of injury to specific areas, they develop mainly as part of the body's total adaptation to the erect posture. The parts of the musculoskeletal system which, in each individual, are especially taxed in the maintenance of the erect, level-eyed posture, will be largely determined by factors of physical configuration, attitudes, habits, occupation, activities, and environment and by the inherent and developing defects, asymmetries, and anomalies.

In the musculoskeletal stress, then, we have identified a very frequent initiating factor, to which man is peculiarly subject, to help account for the local sympatheticotonia found to be associated with, and contributory to, so many apparently different chronic, functional disorders, to which man appears also to be peculiarly susceptible. As will be shown, however, the significance of the musculoskeletal component in disease is not solely in the *initiation* of the local autonomic imbalance.

It appears inadequately understood that the pain, tenderness, muscular rigidity, and autonomic disturbances individually recognized as manifestations of pathologic processes are the interrelated components of a complex response organized by the central nervous system. As was previously stated, the evocative factors which set in motion the segmental response may arise in any tissue or organ as a result of insult to it or excessive demand upon it. The response—organized via the triad of nervous influences (or possibly a tetrad if the trophic functions are included)—is basically the same for all and extends, to some degree, to all the tissues, somatic and visceral, directly related to the corresponding part of the nervous system.[76,98]

Through the reciprocity of influences between visceral and somatic tissues via the central nervous system, visceral pathology produces disturbances in musculoskeletal structures. This is recognized in the concept of the secondary, reflex osteopathic lesion and in the "splinting" associated with painful visceral syndromes. From clinical practice and from numerous studies on such phenomena as referred pain, viscerosomatic reflexes, trigger zones, et cetera, the evidence is convincing that visceral irritation commonly initiates, through reflex pathways, the triad of sensory, autonomic, and motor changes in the somatic tissues, of which a conspicuous feature is muscular rigidity and tension.

It needs to be emphasized, however, that the tender, hypertonic muscles in the reference zone are not merely the reflex *manifestations* of visceral irritation. They and the associated articular and periarticular structures become active participants in the disease process itself as they give rise to disturbed patterns of afferent (proprioceptive) bombardment of the central nervous system which sustain and exacerbate the disturbance in a vicious, self-propelled circle of impulses. In the vertical stance the reflex somatic disturbance is even further intensified under the impact of gravitational stress, tending further to promote the disease process. The total postural response of the patient to gravitational factors is altered, new compensations are exacted, and new stresses set up.

The musculoskeletal component, therefore, is not only an important initiating factor for the facilitated, sympatheticotonic state, but also a sustaining and exacerbating factor even when secondarily induced. Through the inevitable participation of the somatic component, especially that portion in the axial, weight-bearing portion of the trunk, the pathways through the disturbed segments of the cord are maintained in the facilitated state, subject to the exaggerated impact of factors within and without the individual, including that of gravity.

CONCLUSIONS

In this section we endeavor to summarize briefly the etiologic, diagnostic, and therapeutic implications of these findings and conclusions. Testimony to the basic soundness of the etiologic concept is that guides to diagnosis and therapy flow directly from it.

Etiologic Implications.—

1. The "osteopathic lesion," as identified by palpatory and other clinical criteria, is the local or regionally

discrete somatic component of a reflexly organized and sustained response to stresses, irritations, and excessive demands placed upon specific tissues or organs by the environment and by the total activities, responses, and adaptations of the individual.

2. Because of the sustained facilitation of sensory, motor, and autonomic pathways, the lesioned segment acts as a neurologic lens,[75] focusing and exaggerating the effects of impulses from many sources upon the tissues innervated from that segment; through that segment the individual is subject to the exaggerated impact of life situations and environmental factors. To the facilitated segment and the structures which it supplies and therefore to the organism as a whole, even ordinarily innocuous life situations become relatively stressful and taxing and may continually demand and evoke the costly, reserve-reducing protective response.

3. As a special corollary of number 2: Among the source of impulses which exact exaggerated toll of tissues through facilitated segments are the higher cerebral centers. The osteopathic lesion is unquestionably an important determining factor in the bodily expression of emotional ills, conflicts, and tension.

4. The local initiating stresses, in man, arise most frequently in the musculoskeletal system because of his incomplete adaptation to the vertical stance and as part of each individual's postural adaptation to gravitational factors.

5. Regardless of the mode of initiation, however, a somatic component is reflexly established which reflexly exacerbates and sustains the facilitatory process and sensitizes every disease process to the influence of gravity.

6. The local or segmental sympatheticotonia and neurovascular disturbances, increasingly recognized as contributing to endogenous chronic diseases, appear to be a prominent part of this general process.

7. According to conclusions number 2 and 3, whether or not and the rate and degree to which disease develops through the facilitated segment, will be determined by the total demands upon the individual and by the other factors—psychologic, nutritional, social, hereditary, age, et cetera—which influence his total adequacy. We have, therefore, an important reciprocal relationship in which the osteopathic lesion inevitably impairs human adequacy to some extent, while the importance of the lesion to the individual is determined by his *total* adequacy to his total environment and to the life situations he encounters and creates. The lesion increases the importance of every stress and every defect; every stress and every defect renders the importance of the lesion more critical.

8. Since the response to local stress, irritation, or excessive demand is basically the same—through the triad (or tetrad) of nervous influences—the potential clinical manifestations will be determined by the segment involved—and its associated tissues—rather than by the nature of the insult ("etiologic agent") itself. The same process, acting through different segments and tissues, produces a variety of syndromes. The location of the lesion determines the target organs and therefore the potential "diseases." Since the location of the lesions arising in adaptation to the erect posture is significantly influenced by bodily configuration, this appears to be an important factor in the relationship between body type and the incidence of various diseases.

Diagnostic Implications.—

On the basis of the etiologic significance of the lesion just outlined, the finding of an osteopathic lesion marks a segment in which, or through which, the probability of disease is relatively high. At best the lesioned segment is a vulnerable segment, exacting compensations from the entire organism; at worst, it signifies that decompensation has already ensued.

Whereas most diagnostic procedures available today detect the presence of disease processes only after some degree of decompensation has occurred, recognition of the osteopathic lesion reveals early invasion of physiologic reserve and predisposition to disease. Osteopathic lesions appear to be or to reflect the "silent, insidious, fifth column disorders" which leading medical thinkers have concluded need to be sought "in apparently well people"[99] and which are the earliest vanguards of chronic disease.

Therapeutic Implications.—

1. Aside from palliation, therapeutic attention must obviously be given to all the controllable factors in and around each patient which influence his total fitness and resources.

2. Because the facilitation associated with the osteopathic lesion increases the vulnerability of the individual to all factors, decisive, critical importance should be attached to the treatment of osteopathic lesions.

3. Since all existing lesions impair the resources of the ill patient for further resistance and recovery, *regardless of their apparent etiologic relation to the illness,* no therapy can be complete without the maximum liberation of those resources.

4. Whereas, in nonosteopathic practice, the treatment of local or segmental autonomic imbalance ordinarily requires the diffuse alteration of autonomic activity throughout the body, treatment of the lesion offers a specific approach to the local autonomic disturbance associated with many chronic diseases.

5. The direct participation of the somatic component in basic responses to disturbing influences, its accessibility, and its responsiveness to appropriate therapy render it a direct and strategic instrumentality through which to modify the response (the disease process) and to augment the individual's capacity for response, resistance, recovery, and adaptation.

6. In conclusion, since the osteopathic lesion both reflects and influences the adequacy of the individual's reserves and resources, because it reflects and influences the adequacy of his responses to the demands of life, and because it reflects and influences his vulnerability and predisposition, early diagnosis and treatment of the osteopathic lesion offer a direct and systematic approach to the prevention of chronic disease for which, as far as we can tell, there is as yet no substitute.

The origins of the lesion, the processes with which it is associated, and their implications to man's health have hardly begun to be explored. This is the major challenge before the osteopathic profession today.

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Anesthesia Problems in the Geriatric Patient*

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Anesthesia has two important functions. For the surgeon it must provide conditions which will allow rapid and efficient surgery. For the patient it must cause the least possible disturbance in physiology during and after surgery, and it must keep him as comfortable as possible. These functions apply to the geriatric patient as well as to other types of patients. Geriatric patients, however, often present special problems. These problems demand special treatment if a low mortality rate and rapid convalescence are to be achieved.

Many patients over 60 years of age are good risks and require no special treatment as far as anesthesia is concerned. Any of several drugs and technics can be successfully utilized on these good risk patients; the conduct of the anesthesia is more important than the type of anesthesia employed.

In the fair and poor risk patients the choice of anesthesia and the technic to be used are of great importance. In these cases the age of the patient is only one of many factors which must be considered. The type of surgery and the time required are obviously important. The condition of the circulatory, respiratory, excretory, and digestive systems, as well as the temperature and the state of metabolism, hydration, and nutrition, must be considered. These factors must be evaluated before a proper choice of anesthesia can be made. In fact, the patient's condition must be evaluated before coming to a decision as to whether or not surgery should be undertaken. Occasionally the patient is such a poor risk that surgery is not justified, and the operation must be cancelled or deferred while the patient receives further treatment. At the Chicago Osteopathic Hospital we depend upon the medical department to help us evaluate many patients and also to assist us in the preoperative and postoperative care of many poor risk patients such as those with cardiac decompensation or diabetes.

PREOPERATIVE WORK-UP

In the preoperative work-up the following laboratory procedures should be considered routine: erythrocyte count, hemoglobin determination, leukocyte count, determination of differential, bleeding, and coagulation times, urinalysis, determination of blood sugar and nonprotein nitrogen, chest x-ray, and electrocardiogram. In some cases procedures such as liver and kidney function tests and further blood chemistry determinations are required.

Whether or not blood transfusions are required depends on the erythrocyte count, the amount of hemoglobin present, and the type of surgery to be done. The patient should have 12.0 to 12.5 grams of hemoglobin per 100 cc. of blood before coming to surgery, except in case of an emergency. If the hemoglobin is less than this the patient should have a blood transfusion before surgery. More blood may be necessary on the operating table. It is better to give blood slowly before surgery than to give it rapidly at the time of surgery because of the danger of overloading the cardiovascular system.

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Premedication is given for the purpose of making surgery safer and less unpleasant for the patient. Depressing dosages must be avoided, however. Opiate dosages are usually one half to two thirds the average adult dose. Sometimes opiates are omitted. Demerol in dosages of 35 to 50 mg. can be substituted for opiates. Atropine or scopolamine are usually given in average dosages to prevent excessive secretion and protect the heart. Barbiturates usually can be given in one half to one third the adult dose. They help allay apprehension and are advisable especially when local anesthesia is to be used. The exact dosage of the preanesthetic drugs can be determined only after evaluation of each case. If there is doubt as to how much a patient can tolerate it is best to err on the safe side. Too heavy premedication often results in respiratory and circulatory depression.

CHOICE OF ANESTHETIC AGENT

Local infiltration or nerve blocks should be used where they are practical. Paracentesis and reduction of Colles' fracture are examples of what can often be done under this type of anesthesia.

Spinal anesthesia is usually well tolerated in lower abdominal operations, prostatectomies, fractured hips, and amputations. Occasionally it can be used in upper abdominal surgery if the patient is a good risk.

Fractional or continuous spinal anesthesia lessens the danger of sudden or severe drop in blood pressure. In poor risk patients the needle or catheter can be placed in the subarachnoid space, the patient can be placed on his back, and an intravenous infusion started before any anesthetic drug is injected. Then a small dose of the anesthetic drug can be injected into the subarachnoid space. If this small dose depresses the blood pressure more than is expected, a vasoconstrictor can be injected into the tubing of the intravenous setup. This procedure is superior to single dosage spinal anesthesia where a relatively larger dose of the anesthetic drug, which is more apt to cause a serious drop in blood pressure, must be used. It is often more difficult to perform a venipuncture for the administration of vasoconstrictors and fluids after the blood pressure has already dropped.

Smaller dosages of anesthetic drugs can be used in older people because the anesthesia lasts longer than in younger people. All poor risks and most good risk patients should receive oxygen continuously.

The recognized contraindication for spinal anesthesia must be kept in mind when considering its use in the geriatric patient. Some authorities[1,2] list the extremes of age as contraindications but I feel that spinal anesthesia can be used as safely as some other types of anesthesia in many older people. If correctly used, it has many benefits: less respiratory depression, less drug to detoxify, less hemorrhage, better relaxation, et cetera.

Severe intestinal obstruction with distention is considered to be a contraindication to the use of spinal anesthesia because of the possibility of vomiting and aspiration of intestinal fluid into the lungs. This type of obstruction is often encountered in the older age group. If general anesthesia is used when vomiting and aspiration are likely to occur a cuffed endotracheal tube should be in place before surgery is started. With the cuff of the endotracheal tube inflated it should be airtight, and aspiration is practically impossible. A good airway is assured.

REFRIGERATION ANESTHESIA

Occasionally it is necessary to use refrigeration anesthesia for amputations. Usually spinal anesthesia is tolerated quite well for amputation of the lower extremities but on very poor risk patients refrigeration can be used to advantage.

GENERAL ANESTHESIA

Often general anesthesia is the anesthesia of choice for geriatric patients. The induction should be as smooth as can be managed, avoiding the excitement stage if possible, especially in the hypertensive patient. Premedication helps in this respect. Pentothal sodium often can be used for induction unless there is shock, severe hemorrhage, or dyspnea.

Carbon dioxide excess and hypoxia must be avoided. To keep the patient well oxygenated the circulation must be adequate, a good airway must be maintained, and a gaseous mixture containing plenty of oxygen is essential. In connection with this requirement, nitrous oxide and ethylene must be used with great care, usually combined with some other anesthetic agent such as Pentothal or ether. The oxygen concentration is preferably kept above 50 per cent and is never allowed to go below 20 per cent.

Cyclopropane, because of its greater potency, allows for a greater concentration of oxygen. This characteristic and its qualities of rapid induction and not too disagreeable odor make it a very good agent in many cases. Cyclopropane can be used alone, but better results are often obtained when it is used in conjunction with Pentothal sodium or ether. However, most authorities[3,4] feel that cyclopropane should not be used in the presence of pathology of the cardiac conduction mechanism because of its tendency to produce arrhythmias.

Large amounts of ether should be avoided because of the possibility of liver or kidney damage and the prolonged recovery period. Ether is sometimes useful combined with cyclopropane or nitrous oxide, as noted previously.

Pentothal sodium must be used very cautiously, if at all, and it can seldom be used alone. It can be used for induction as mentioned above, and it can be used in combination with other anesthetic agents. The contraindications to the use of Pentohal must be observed. These include myocardial disease, hypotension, shock, anemia, acute respiratory disease, liver and kidney disease, and acidosis.

The muscle relaxing agents such as d-tubocurarine chloride are of great value in many abdominal cases. When curare is used the amount of anesthetic agent used can be lessened, although curare has no anesthetic effect in average doses. Light anesthesia is important in poor risk patients because it lessens the danger of complications during and after surgery. Curare itself, however, can cause respiratory depression. It must be used cautiously and in small doses. The anesthetist must be sure that the effect of the curare has sufficiently worn off before returning the patient to his room. The curare-antagonizing agents seldom need to be used, and they sometimes give a false sense of security.

Regardless of the type of anesthetic chosen it must be administered properly so that hypoxia, circulatory depression, and respiratory depression are prevented. These three conditions are related. Proper use of oxygen and the various types of airways help prevent

hypoxia. Use of vasoconstrictors and intravenous fluids, including blood, help prevent circulatory depression. Avoiding overdosage of preanesthetic or anesthetic drugs helps prevent respiratory depression. Extreme Trendelenburg position for long periods is not tolerated well by older patients.

POSTOPERATIVE PERIOD

Postoperative complications are more apt to occur in the geriatric patient than in those of other ages. However, much can be done to lower the incidence of these complications.

Every attempt should be made to return the patient to his room in a condition that is near normal for this patient, and he should be awake and cooperating if possible. This is impossible in many cases, and very active treatment is necessary in the immediate postoperative period. Oxygen by tent or catheter is sometimes necessary; intravenous fluids or blood and vasoconstrictors are often needed.

Hypostatic pneumonia, cardiac decompensation, paralytic ileus, and thrombophlebitis are common complications. Early ambulation and activity are very helpful in preventing these complications. Osteopathic manipulative treatment is very important, especially in patients who cannot be ambulated.

SUMMARY AND CONCLUSIONS

There are several things important in the management of anesthesia in the geriatric patient.

1. Evaluation of a patient's condition and preoperative preparation are extremely important. Age is only one of several factors to be considered.

2. Choice of anesthetic agents is important, but the conduct of anesthesia is more important.

3. Individualization is necessary as to premedication, agents, and technic.

4. Hypoxia, circulatory depression, and respiratory depression are to be avoided. The patient should be returned to his room awake and cooperative, if possible.

5. Light but adequate anesthesia making use of agents and technics that allow a rapid return to normal is the ideal to be sought.

6. Osteopathic manipulative therapy, especially in patients who cannot be ambulated, is important in the avoidance of postoperative complications.

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Leprosy

A Present-Day Interpretation

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The modern American physician confronted with consideration of leprosy may find himself totally unable to rationalize this disease with his usual medical acumen. Indeed, even if his interest is high, he may find it difficult to place leprosy in an understandable light because of the paucity of available patient-study material. In an area such as the United States where this disease is statistically rare, only the most curious will pursue this interesting medical entity.

It is the purpose of this paper, therefore, to present a present-day interpretation of leprosy, including the latest thinking in this field and an attempt to rectify some of the misunderstandings so prevalent in the attitude toward this ancient plight of mankind. In no respect is the above meant to imply that this paper is the final word in a study of leprosy, for in this disease as in others, developments occur so rapidly that any day one may have to change his thinking completely over the day previous. Rather, my aim is to offer a general understanding of leprosy with its various medical, social, economic, and philosophic ramifications. Many of the complications and deleterious effects of leprosy can only be mentioned, and some will not be mentioned at all.

Leprosy is the oldest known disease of man.[1] Though the validity is doubted by some, reference to leprosy in Negro slaves is made as early as the reign of Ramses II (1300 B.C.) Some believe the Vedas of 1400 B.C. refer to leprosy in India. In the time of Confucius, 2,500 years ago, reference is probably made to this disease. The Bible refers to leprosy in Genesis, and by the time of Jesus, rigid rules and regulations existed controlling the rights and limitations of the person with leprosy. However, Biblical allusions are doubtless to many skin diseases other than leprosy such as psoriasis, leukoderma, eczema, and lichen. Especially does this seem true when mention is made of improvement occurring in a few days.[1] It was the custom in those days for the "cleansing of the leper" to be a function of the priest. Various rites were performed in consummation of this act. That the one unfortunate enough to have contracted the disease in question was considered unclean came directly from the religious concept that disease was the direct result of sin, and therefore a form of punishment. Even today this concept is extant throughout the world, particularly in regard to leprosy.

Upon contact for the first time with a person with leprosy, one usually has a sensation of having been totally contaminated, and the very air he breaths seems laden with the substance which causes this horrible disease. Such is the power of religious thinking in our lives whether we appreciate it or not. That leprosy is infectious there is no doubt. That leprosy is only very slightly infectious there is also no doubt. According to Cochrane,[2] it is almost impossible for an adult to contract leprosy. He also says[3] that the majority of patients in India manifest signs of leprosy before they are 20 years of age and many before they are 15 years old. Furthermore, most, if not all, of those manifesting the disease after this age were exposed before this period; there is a long latent period between infection and clinical appearance of the disease. Leprosy has been

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known to appear in a 6-month-old infant and in an adult 40 years after leaving an endemic area. The latent period is, however, more likely to be a matter of years than of months.[3] According to Muir,[4] the average is about 3½ years.

INCIDENCE

It is impossible to determine accurately the incidence of leprosy throughout the world, but it has been estimated that there are over 1,000,000 cases in India, over 400,000 in Nigeria alone, and probably over 3,500,000 throughout the world.[5] Hopkins and Aranjo[6] have estimated that in the United States there are 1,865 cases of leprosy, or 0.02 per square mile, as compared to 20 per square mile in the Belgian Congo.

ETIOLOGY

Leprosy is caused by the Mycobacterium leprae, an acid-fast bacillus quite similar to the Mycobacterium tuberculosis, though there are certain characteristics which may distinguish them microscopically. That the former is more alcohol fast and the latter more acid fast is of value in differential staining. The tuberculosis bacillus tends to be somewhat longer and thinner than the leprosy bacillus which becomes less elongated as healing takes place, later becoming more cigar-shaped than coccal, and finally granular before histologic extinction.

That this bacillus is the cause of leprosy there can be little doubt, although to date there has been no proved success in growing the bacillus artificially.

CLASSIFICATION

In order to understand the histology of leprosy it is necessary to consider classification. The Cairo Classification (1938) is the most familiar and classifies the types as neural, dermal (lepromatous), or mixed, which is a combination of the first two. This classification, though a beginning, takes no cognizance of the actual basis for differentiation of the type, which is immunologic. Further, as later histopathogic studies have shown, all leprosy is neural in origin as it begins in the small nerve plexuses of the skin and subcutaneous tissue.

A classification has evolved which includes only two types: tuberculoid and lepromatous. Unfortunately or fortunately, as the case may be, not all cases can be so conclusively defined. Early in the disease process, or later in the healing phase, the signs, both clinically and histologically, show a state of transition and are therefore termed "atypical" or "borderline." Classification may then be demonstrated as showing tuberculoid and lepromatous at opposite poles with the borderline between tending toward one or the other pole, but more often toward the lepromatous pole. Histologically the borderline group shows a picture of "tissue in panic"[2] and evidences characteristics common to both tuberculoid or lepromatous lesions, but the type of tissue response which predominates depends upon which pole it approaches.

HISTOPATHOLOGY

To understand further the pathologic process one must understand the immunologic process involved. Entry of the invading organism is through the skin (probably a scratch or abrasion), and the small nerve plexuses, hair follicles, and the sweat glands are involved. As this occurs there is a typical reaction to infection with round cell infiltration of the area, with an influx of macrophages and an attempt to wall off and phagocytose the invading organism. It is at this point that the type differentiation begins. If the person is immunologically capable of handling this invasion the organism is "fixed" at this point. If this takes place very early there may never be any signs or symptoms of leprosy and the person has had a "silent" atypical form.

If the disease process develops clinically and is held in abeyance by the immunity of the person his lesion will remain local and constitute the tuberculoid type. In this type the reaction to infection continues, and after the round cell infiltration, histocytes appear to facilitate the phagocytosis of the invading bacteria. The resulting pathologic lesion is quite similar to the tubercule of tuberculosis, thus accounting for the name in this type of leprosy.

In the lepromatous type immunity is lacking. As a result there is no fixation of the bacilli, but rather a general dissemination. Although leprosy bacilli have been found in the liver and spleen, the effects are generally limited to the skin and its appendages, with the notable exception of the testes and the cartilage and bone of the nose. The eye may be involved in much the same manner as the skin.

Because the bacilli are not fixed and the process of inflammation not present, the bacilli are phagocytosed by macrophages and the beginnings of the typical leproma, or histopathogic lesion of lepromatous leprosy, is begun. In the tuberculoid type an occasional bacillus is seen in association with the round cell infiltration, but in the leproma the entire macrophage may be filled with bacteria. As degeneration within this cell takes place, the macrophages present a foamy appearance, which is the characteristic lesion of lepromatous leprosy known as the vacuolated cell of Virchow.[7]

To state it simply, the entire process and type determination are determined by the immunologic reaction; that is, a particular immunologic response creates a particular type of leprosy lesion. The presence of this response can be demonstrated by the lepromin skin reaction, a skin reaction comparable to the tuberculin test in tuberculosis. As with the tuberculin test, a positive result of the lepromin test does not necessarily prove activity or severity of the disease, but only the person's ability to react to the invading process. It is apparent then that the results of the lepromin test will be positive in the tuberculoid type and negative in the lepromatous type, and that they may be either positive or negative in the borderline group. The lepromin test, therefore, is not a diagnostic procedure; it is only of value in type classification. In doubtful cases it may offer considerable aid in differentiation, but in the typical lesion, either tuberculoid or lepromatous, the lepromin test can be precisely predicted. It is interesting that BCG vaccine has been found to influence the lepromin test in that with its use negative lepromin reactors have been changed to positive reactors. What this might ultimately mean remains to be proved. Speculation leads one to believe that the former nonreactor (to lepromin) has been able with the aid of BCG to muster enough immunity to cause him to develop the less severe tuberculoid type rather than the lepromatous, if not actually to be able to eliminate the disease process without further treatment, as is the rule in tuberculoid leprosy. Further results of these studies are awaited expectantly.

CLINICAL STUDIES

We can now appreciate the Madrid Classification established in 1953 at the International Congress of Leprosy at Madrid, Spain:[2]

MADRID CLASSIFICATION

Indeterminate (I)	*Tuberculoid* (T)	*Lepromatous* (L)	*Borderline* (B)
Macular	Macular	Macular	Macular
Neuritic (p.)	(Maculo-anesthetic	Diffuse	Infiltrated
	Minor	Infiltrated	Atypical Tuberculoid
	Major	Nodular	Atypical Lepromatous
	Neuritic (p.)	Neuritic (p.)	Neuritic

It would now seem that the lesion type should be readily recognizable, and this is true where there is definite polarization of the disease. A tuberculoid lesion with its definite, clearly defined border, flat or raised (macular or infiltrated), evidences immunologic fixation. More than one lesion of the body may be present, but each will typify this response. And because the sweat glands, hair follicles, and small nerve endings are involved the lesion will be dry, scaly, hyperpigmented or hypopigmented, and anesthetic.

If one tests the sweating response (with pilocarpine et cetera) of these lesions, definite inhibition of the sweating process can be shown. That this is true is interestingly demonstrated when a patient who has been lying in the dust is examined. His perspiration breaks through everywhere except where leprosy exists, with excellent definition of the lesion. That the nerve endings are involved in this tuberculoid lesion can be as readily demonstrated by simple light touch with cotton or the hot and cold test. In longer standing cases the nerve involvement (anesthesia) is dramatically demonstrated because a surgical procedure such as the amputation of a digit or a foot can be performed without anesthesia. This is, of course, the extreme state that one who is treating leprosy dreads to see, for the optimum time for beneficial care has passed. The lepromin test will be strongly positive in this tuberculoid type.

The lepromatous lesion, in contradistinction to the tuberculoid, shows very poor definition of its macular border and, rather than being dry and scaly, is shiny and smooth. Anesthesia, if present, is minimal and is not characteristic of this type. A macule may be definite enough, but where it and normal tissue meet is not well defined, as would be expected when one understands the immunohistologic basis of the lesion genesis. The lepromin test will be negative. In the frank leproma, with thickening or actual nodulation of the ears, and on the brow and elsewhere, the type differentiation requires no great diagnostic acumen. However, because of the importance of segregating the infectious case, it is essential that this differentiation be made before these signs become so definite.

It need only be added that the leproma is always found to be bacteriologically positive by standard methods (skin scrapings), and the tuberculoid type never positive (with the exception of a strongly reacting tuberculoid, in which one may often demonstrate bacteria in the skin). "Bacteriologically positive" is used to refer to results of examination performed by ordinary methods. If one is careful enough in dissecting out the small nerve endings in the lesion area he can always demonstrate bacteria, even in the tuberculoid case. But this is not a "standard" method, and therefore it is commonly accepted by leprologists that the "standard" method refers to the common skin and nasal smears which are used in classing a case as "open" or "closed." The open and closed types will be dealt with a little later when prevention is being considered.

Discussion of the borderline group will be limited to re-emphasizing what was said above: This group, being an unstable one with lesions which are in a state of transition, may clinically, as well as histopathologically, demonstrate signs of either or both the tuberculoid or the lepromatous type. Those signs predominating are dependent upon the pole toward which the disease tends. As one pole is approached, differentiation becomes more difficult and may at times be only demonstrable by biopsy. The borderline group may or may not exhibit anesthesia and disturbance of sweating; it may be lepromin positive or negative; and it may or may not be bacteriologically positive.

TREATMENT

Treatment in leprosy must, as in any disease, be approached prophylactically as well as therapeutically. Even considering the recent dramatic advances in therapy, prophylactic efforts are, in my opinion, far more important than medical or surgical management of this disease. True, we need and must use these, but the case for prevention by segregation of the infective person, especially from children, has proved itself. If 80 per cent of all leprosy patients are infected before 15 to 20 years of age,[1] it is apparent where our efforts then must be aimed if control and eventual elimination are to be realized. It is pertinent to note at this point that in the Scandinavian countries the leprosy incidence has been reduced from some thousands of cases to practically none by voluntary segregation. In Norway, for instance, in 1855 there were almost 3,000 cases. The number was reduced to twelve by 1951.[9] And all of this before the use of the sulfones! The ultimate aim of all medicine must be prevention if disease is ever to be conquered.

With the introduction of sulfone therapy in leprosy the immediate cry, as with any new chemotherapeutic or antibiotic agent, was "At last we have arrived!" But, as with these other "miracle drugs," it was soon observed that the anticipated utilization of the agent was prevented because of allergic sensitivity, poor general condition of the patient, or sensitization of the invading organism to the sulfone. Medical treatment of leprosy is now in the phase where we can begin to evaluate this new and valuable weapon intelligently and re-evaluate other measures in line with this new thinking.

All over the world diaminodiphenylsulfone is being used in the treatment of leprosy in conjunction with the other necessary methods. And yet, just as if to prove the bubble has not completely collapsed, this year the Ministry of Health of a large endemic area circularized all leprosy centers and government officials saying in effect that with diaminodiphenylsulfone the larger leprosy settlement or segregation village as such was no longer needed, that the various dispensaries could now carry out treatment largely by giving to all possible the "little white pill"! The necessity for segregation (which would, if administered adequately, eliminate leprosy with this generation) and other phases of

the work were entirely subjugated to passing out a relatively new and potentially dangerous drug.

Fortunately, in this same area all leprosy work, with the exception of some native authority dispensaries, is done under the supervision of the missions and a general vocal rebellion can still be heard in reply to this circular. Although the great usefulness of diaminodiphenylsulfone was recognized, it became necessary for those doing actual work with leprosy to reemphasize other aspects of therapy.

With these general comments it is hoped to establish thoroughly the value of prevention and control of leprosy by adequately and properly administered segregation of the infectious case. The closed case, that is, the patient with the noninfectious tuberculoid type, is no more likely to transmit leprosy than the person with psoriasis is likely to transmit his disease.

The specific treatment of leprosy today is by means of diaminodiphenylsulfone which is usually administered twice weekly only. The original drugs (Promin, Diasone, Sulfetrone, et cetera) have all been found to contain the same common active substance, diaminodiphenylsulfone. This substance is produced in the stomach when the various sulfone drugs are broken down by the gastric juices. From this it is obvious that economy and efficiency of treatment depend upon use of the parent substance.

Diaminodiphenylsulfone is a potent liver toxin and is not to be given indiscriminately; even under the best of circumstances deleterious effects occur. Of these, toxic hepatitis, by far the most severe, may often prove fatal. A severe anemia usually accompanies the hepatitis, but can well occur alone. Unless the drug is stopped and antianemic measures instituted, death is to be expected.

Also most distressing may be an allergic exfoliative dermatitis such as is seen with any drug sensitivity. When proper measures are applied and with early withdrawal of the drug, this reaction clears in due time. Lastly, psychosis, which is probably a precipitated mental change rather than a true toxic psychosis, may occur. Patients who become psychotic can usually be treated later quite satisfactorily with diaminodiphenylsulfone on one half the previous dosage.

For those who are unable to tolerate oral diaminodiphenylsulfone, a second choice is available in the form of aqueous Sulfetrone. When administered parenterally, Sulfetrone is not broken down and therefore makes sulfone therapy possible for many who cannot tolerate the parent drug. A third choice, when neither of these is utilizable, is thiosemicarbazone. This drug was originally thought to be a "wonder drug" for tuberculosis, but it proved to be too toxic in adequate dosage. Administered in less toxic amounts, it has been found to be effective in leprosy. According to Cochrane[2] it is a poor third choice, and, because the danger that it will produce agranulocytosis is present, it must be given only with adequate supervision.

Other but less effective drugs are available. Streptomycin has demonstrated some value, and of course hydnocarpus oil still has its advocates, with some justification. Hydnocarpus oil has a definite effect on the course of leprosy and produces more rapid change than even the sulfones. However, these changes soon develop more slowly and the drug seems unable to push its advantage to a successful conclusion. The lepromatous patient can hardly expect release from a sanitorium if he is being treated only with hydnocarpus oil.

SURGICAL THERAPY

The surgical aspects of leprosy are changing so rapidly that more and more time is demanded in this phase of the work. Here again prevention is the aim, and such procedures as early stripping of the reacting nerve can not only prevent extreme deformity, but may actually change the course of the disease.

Reaction within a nerve is always dangerous. As swelling takes place, the nerve sheath prevents expansion beyond a point, and nerve damage, if not actually complete destruction of the nerve tissue, occurs unless something is done immediately to relieve the pressure. When instituted early, surgery is dramatic in its effect, with almost immediate relief from pain and early return to normal of beginning deformities. This is especially true when proper physical therapeutic efforts are made. It is the failure to apply surgery early that allows development of the "claw hand" of leprosy in which first the ulnar, then the median, and finally the radial nerves in the forearm are involved. Foot drop is also a common result when the superficial peroneal nerve becomes involved near the head of the fibula. A typical Bell's palsy follows facial nerve involvement.

Surgery in the late cases, which for some reason or another failed to receive proper care earlier, is now entering a phase in which the results are little short of marvelous. Those with disabling and disfiguring effects of leprosy can now hope for results as wonderful as those that have been accomplished with harelip and other unsightly deformities. Returning the patient with leprosy to occupational status offers him the opportunity of living as a useful member of society rather than as a pauper and beggar.

CONCLUSIONS AND SUMMARY

In spite of the amazing advances in the treatment of leprosy, this disease remains a definite health menace throughout the world. It is a disease spread by close contact and is therefore more prevalent in poorer economic groups, especially where crowded living conditions exist.

The greatest single factor in control and elimination of leprosy is still segregation of the infectious cases, especially from children who may become infected but not manifest the disease for several years.

Leprosy, as other diseases such as syphilis and the psychoses, has strong social implications, religious in background. Therefore, the emotional response to contact with the disease is out of proportion to its potential effects. In certain areas, such as in North America, there is a horror of seeing, let alone being in contact with, one afflicted with leprosy. In other areas people have not even a healthy fear of the disease. Somewhere between these is the intelligent position, the position which must necessarily be that of the physician. He, because of his intelligent understanding of the disease process, must demonstrate a rational approach for those lacking this understanding.

The outlook for the control and eventual conquest of leprosy is good. Until recently international groups, mainly missions, have constituted almost the only attackers of this vast problem. However, the interest of local groups has now been precipitated, and they, working in unison with the United Nations, may ultimately be the deciding factor in gaining control. Continued advances of medical and surgical modalities offer amazing possibilities when compared to those formerly available. These advances coupled with local administrative ef-

forts at effective control measures may well bring about the end of this disease in the foreseeable future. This being true, a former social outcast can expect not only to re-enter his normal social stratum, but also may become a useful and even leading citizen in his country.

An effort has been put forth in writing this paper to offer a general understanding of leprosy as its exists today. It is hoped that enough interest may have been aroused to stimulate the reader to seek to know more about this most interesting and historical disease.

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A Study of the Visual Effects of Therapeutic Doses of Nembutal Sodium and Amphetamine on the Human Eye

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INTRODUCTION

Visual acuity means distinctness of vision. The term is applied especially to direct or central vision, although it is a relative term and may be applied to indirect vision. Visual acuity is the ability of the eye to recognize minute points of definite size as separate points at a definite distance, spatial perception, or a point of definite size at a definite distance.[1,2] Heterophoria is late latent deviation and implies a muscle imbalance of the concomitant type. The lateral phorias are divided into esophoria and exophoria. Esophoria is present when there is an inward deviation of one eye only when that eye is covered. Exophoria is present when there is an outward deviation of the eye when that eye is covered.[3,4] Stereopsis is the binocular perception of depth. Stereoscopic vision consists of all the factors which operate in the case of each eye separately plus the convergence of the eye axes and the dissimilarity between the images which are formed on the two retinae.[5,6]

THE PROBLEM

The object of this investigation was to study, on the human eye, the depressant action of therapeutic doses of Nembutal sodium and the stimulant action of therapeutic doses of amphetamine sulfate (Benzedrine) on visual acuity, lateral phoria, and stereopsis.

Method and Technic.—

This experiment was carried on under the auspices of the Department of Pharmacology and Physiology of the Kansas City College of Osteopathy and Surgery. A Keystone stereoscope with constant light source and shaft setting equivalent to 20 feet was maintained throughout all testing. The targets or cards used in the test were of the standard Keystone Visual Survey Series: (1) Visual acuity cards DB2 and DB3, (2) lateral phoria card DB9, and (3) stereopsis card DB6D. All targets used were especially designed for a far point setting on shaft equivalent to 20 linear feet. The card for the visual acuity allows the subject to focus the target with both eyes, yet only one eye at a time is being tested for visual acuity. Test findings are expressed as percentages. Ordinarily 100 per cent acuity is equivalent to 20/20 vision. However, a finding of 50 per cent does not mean that the individual has only 50 per cent of vision. It is only meaningful when compared to a subsequent finding which may either increase or decrease and thus allow comparison.

In the muscle balance test (lateral phoria), a finding of 7 to 9 is normal. Under 7 indicates overconvergence and over 9 indicates underconvergence of the ocular muscles. There are twelve examples of stereopsis of increasing difficulty shown to each subject. Thus an individual with no depth perception rates zero. Fair depth perception ranges between 6 and 8. Excellent perception rates 12. Two groups of healthy male students, ten in one and eleven in the other, took part in the experiment. The age range was from 22 to 37 years of age.

The first group, consisting of ten students, received 5 mg. of amphetamine sulfate after an initial finding was taken. Subsequently after a 15-minute interval, tests were made, then another 5 mg. of amphetamine sulfate were administered and another 15 minutes were allowed to elapse before a third battery of tests was given. Fifteen additional minutes were allowed to elapse; this time, however, no additional amphetamine sulfate was given. Therefore, the total cumulative dose at the last battery of tests was 10 mg. of amphetamine sulfate.

In the second group, which consisted of eleven students, the same procedure was followed, only 50 mg. of Nembutal sodium was given after the initial battery of tests and an additional 50 mg. after the second battery of tests. Thus the total cumulative dose at the third and fourth test battery findings was 100 mg. of Nembutal sodium.

Results.—

The basic data by which comparisons within each group were made consist of the findings for visual acuity, lateral phoria, and stereopsis taken before and after drug administration. The means were calculated.[7,8] To determine whether any of the obtained differences between these means were statistically significant, the significance ratios of the obtained differences were calculated.[8] This was done for the group with ten subjects and for the group with eleven subjects.

In calculation of the standard error of the means, the formula for small samples was used.[8] The tables, I-VI, are arranged to show the mean, M, the standard deviation of the means, SD_M the standard deviation of the obtained difference of the means, SD_D and the significance ratio, $SR = \frac{D}{SD_M}$, where D= the obtained difference of the means.[7,8]

TABLE I—VISUAL ACUITY—AMPHETAMINE SULFATE (10 SUBJECTS)

	Mean	SD_M	SD_D	Significance Ratio
Inital finding				
O.D.	95.5	3.45		
O.S.	96.5	3.73		
15 min. later				
O.D.	99.5	1.73	3.87	Less than 1
O.S.	97.5	3.00	4.79	Less than 1
30 min. later				
O.D.	98.5	2.79	4.36	Less than 1
O.S.	96.5	3.94	5.40	Less than 1
45 min. later				
O.D.	101	2.08	4.0	Less than 2
O.S.	102	1.52	4.0	Less than 2

TABLE II—LATERAL PHORIA—AMPHETAMINE SULFATE (10 SUBJECTS)

	Mean	SD_M	SD_D	Significance Ratio
Initial finding	7.35	.466		
15 min. later	7.40	.450	1.54	Less than 1
30 min. later	7.45	.400	.71	Less than 2
45 min. later	7.75	.326	1.52	Less than 1

TABLE III—STEREOPSIS—AMPHETAMINE SULFATE (10 SUBJECTS)

	Mean	SD_M	SD_D	Significance Ratio
Initial finding	9.3	1.41		
15 min. later	10.5	.986	1.74	Less than 1
30 min. later	10.5	.986	1.74	Less than 1
45 min. later	9.0	1.210	1.80	Less than 1

TABLE IV—VISUAL ACUITY—NEMBUTAL SODIUM (11 SUBJECTS)

	Mean	SD_M	SD_D	Significance Ratio
Initial finding				
O.D.	94.54	4.29		
O.S.	86.00	5.21		
15 min. later				
O.D.	100.00	2.30	13.34	Less than 1
O.S.	92.30	1.05	5.30	Less than 2
30 min. later				
O.D.	93.20	4.48	13.89	Less than 1
O.S.	92.70	4.23	6.70	Exactly 1
45 min. later				
O.D.	99.0	2.90	13.45	Less than 1
O.S.	94.5	3.59	6.33	Less than 2

TABLE V—LATERAL PHORIA—NEMBUTAL SODIUM (11 SUBJECTS)

	Mean	SD_M	SD_D	Significance Ratio
Initial finding	7.98	.447		
15 min. later	7.90	.731	86	Less than 1
30 min. later	7.80	.733	.86	Less than 1
45 min. later	6.80	.712	.83	Less than 2

TABLE VI—STEREOPSIS—NEMBUTAL SODIUM (11 SUBJECTS)

	Mean	SD_M	SD_D	Significance Ratio
Initial finding	9.45	1.30		
15 min. later	8.27	1.50	1.98	Less than 1
30 min. later	7.81	1.64	2.10	Less than 1
45 min. later	8.55	1.55	2.00	Less than 1

For the group of ten subjects, reference to Tables I, II, and III shows that the significance ratio is less than 2, 15 minutes, 30 minutes, and 45 minutes after oral administration of amphetamine sulfate in therapeutic doses.

Similarly for the group of eleven subjects, a study of Tables IV, V, and VI reveals that the significance ratio is less than 2, 15 minutes, 30 minutes, and 45 minutes after oral administration of Nembutal sodium in therapeutic doses.

CONCLUSION

1. Therapeutic doses of amphetamine sulfate given orally to normal healthy young males produced no significant difference in visual acuity, lateral phoria, or stereopsis.

2. Therapeutic doses of Nembutal sodium given orally to normal healthy young males produced no significant difference in visual acuity, lateral phoria, or stereopsis.

DISCUSSION

Amphetamine sulfate is a potent stimulator of the central nervous system.[9-11] The main sites of its action are thought to be the cerebral cortex and the hypothalamus.[11]

All of the effects of amphetamine sulfate on the human eye have not been investigated.[12]

In this study, therapeutic doses of amphetamine sulfate had no significant effect on visual acuity, stereopsis, or lateral phoria. However, in another study by other investigators 10 mg. of amphetamine were administered to fifty normal healthy males 17 to 40 years old. The reading speed and visual acuity 2 hours later were determined for each eye separately and for both eyes. For the right eye, the average reading speed improved from .358 seconds per letter in the controls to .245 seconds. Visual acuity improved from 20/17.2 in the controls to 20/14.4. For the left eye the average reading speed improved from .363 per letter in the controls to .225 seconds. Visual acuity improved from 20/17.4 in the controls to 20/14.5. For both eyes the average reading speed improved from .317 seconds per letter in the controls to .209 seconds. Visual acuity improved from 20/15.95 to 20/13.3.[13]

Amphetamine sulfate dilates the pupils when instilled in the conjunctival sac. The intraocular pressure is not significantly elevated, accommodation is not affected, and the pupil rapidly returns to normal. The light reflex does not disappear unless amphetamine sulfate is repeatedly given.[9]

Toxic effects produced by amphetamine usually are extensions of its therapeutic actions and usually are due to overdosage, which, among other things, may cause marked mydriasis, insomnia, restlessness, talkativeness, vexation or happiness, headache, fatigue, and mental depression. Subjects may feel that time passes quicker. Psychoses with hallucinations, resembling delirium tremens, may occur.[9-11,14,15]

The major action of Nembutal sodium is central nervous system depression.[9] Therapeutic doses of Nembutal sodium produced no significant effect on

visual acuity, stereopsis, or lateral phoria. A search of the literature failed to reveal any findings on this subject. In acute barbiturate poisoning, among other things, the pupils react to light and are constricted, but at times they may be dilated. Sometimes they are pin point in size and do not respond to light.[9,14,15] One author states that the pupils are usually dilated but may, in severe cases, be constricted and unequal until asphyxial dilatation occurs.[10] Nystagmus and strabismus have been noted frequently, and diplopia has occurred.[10,11] Confusion, drowsiness, and coma are present.[14,15]

In chronic barbiturate poisoning, among other things, there may be slowness of thought, mental depression, incoherent speech, failing memory, ataxic gait, emotional instability, some mental confusion, loss of self control, changes in behavior, dizziness, psychotic symptoms, diplopia, nystagmus, ptosis, paresis of eye muscles, amaurosis, optic neuritis, headache, visual hallucinations, and coarse tremors of lips, fingers, and tongue.[10,14,15]

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Use of a New Drug Combination (Pentoxylon) in Angina Pectoris and Status Anginosus

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It is debatable whether it will ever be possible to achieve an ideal therapy for coronary insufficiency. The chief therapeutic approach to date has been the use of coronary vasodilators, and, among these, nitroglycerin, introduced originally by Murrell[1] in 1879, is still the standard.

It cannot be denied that the coronary vasodilatation produced by nitroglycerin or other nitrites is a useful procedure for relieving an acute ischemic episode. But is this enough? The clinician has long sought a therapy that would also help in the actual prevention of attacks and, furthermore, aid in relieving the anxiety and apprehension of the patient who lives in constant dread of the next attack.

Such a comprehensive therapy seemed available in a combination drug (Pentoxylon, Riker Laboratories) recently made available. Pentoxylon is a combination of pentaerythritol tetranitrate, PETN, a long-lasting coronary vasodilator; and Rauwiloid, an alkaloid extract of Rauwolfia serpentina, which has a bradycardic, tranquilizing, and mild hypotensive action. Thus Pentoxylon seems to offer a rational and comprehensive therapy for coronary insufficiency. Each long-acting tablet contains 10 mg. of PETN and 1 mg. of Rauwiloid. This report concerns the results obtained with Pentoxylon in the first ten unselected cases of coronary heart disease to come under my care since this preparation became available. The cases represent a random sampling of cardiopathies and were not selected as uncomplicated or with a favorable prognosis. The evaluation of the response in each case is based on several factors: (1) subjective improvement, (2) reduction in nitroglycerin requirements, (3) reduction in frequency as well as in severity of anginal attacks, (4) increase in exercise tolerance, (5) reduction of pre-existing tachycardia, (6) reduction of anxiety relative to forthcoming attacks of pain, and (7) reduction of blood pressure in hypertensive patients. I do not feel that the electrocardiogram is totally reliable in many cases, and it is frequently impractical to obtain a sufficient number of tracings on outpatients to be of real value.

METHODS AND MATERIALS

The ten patients whose cases are reported here are the first ten with significant coronary insufficiency to come under my care after Pentoxylon was made available. They were unselected cases and constitute a random sampling of cardiopathies.

The usual dose of Pentoxylon was 6 tablets daily to start and was usually reduced to 4 tablets daily in a short time. Side reactions were infrequent and minor. The use of Pentoxylon did not interfere with any other indicated medication.

RESULTS

The response of the ten patients to the therapy was as follows:

Case 1. Paroxysmal episodes of a crushing weight-on-the-chest sensation in the central and left precordium with left ulnar and left cervical radiation were complained of by a 34-year-old white male when he was first seen as an outpatient on January 20, 1954.

The episodes were almost invariably precipitated by a situation producing emotional stress, the most common of which was anger. The patient readily admitted that he had an ungovernable temper. His family history was not pertinent except that his father died of an unidentified febrile disease at the age of 54. He had seen other physicians who had prescribed nitroglycerin for him. One year before he appeared as an outpatient, this drug would promptly terminate an attack but was gradually becoming less and less effective. His basal electrocardiogram was classically normal. Attempts to produce significant electrocardiographic alterations by the Master test were unsuccessful even when considerably more than the prescribed amount of activity was used. All other laboratory and physical findings were uninformative except that there was a very mild microcytic anemia which was not even regarded as worthy of treatment. The patient was placed on lipotropics and a cholagogue and was told to return in 1 month. On February 17, 1954, additional attempts made to induce electrocardiographic changes by exercise were again unsuccessful. At this visit the patient was placed on nitroglycerin plus PETN, 40 mg. daily. The first week's treatment improved the patient to some degree but by no means achieved complete control.

Sedation was difficult to obtain in this patient since he was violently allergic to barbiturates, overresponsive to bromides, and nauseated by chloral hydrate. On February 25, 1954, he returned to my office during an episode of his distress which was occasioned by anger at receiving my bill. While he was still angry and complaining, an electrocardiogram was made. This record demonstrated slight but definite changes involving T wave amplitude and direction, S-T segment depression in V-5 and V-6, and cardioacceleration. These changes were noted to persist for 7 minutes until 0.01 grain of nitroglycerin placed under the patient's tongue began to alleviate the distress. Ten minutes later another electrocardiogram was recorded which was again classically physiologic. The Master exercise test again failed to produce any significant electrocardiographic alteration. The patient was placed on Ethaverine and nitroglycerin therapy and was told to report in 1 month. The next visit was on April 7, 1954, at which time the patient reported some improvement, but he still had daily episodes. During this visit he was given a supply of Pentoxylon tablets and was told to take 6 per day and to report in 2 weeks.

At the next visit the patient reported definite clinical improvement, although he had had some difficulty that very morning. His nitroglycerin requirements were reduced from about 2 tablets daily to about 5 tablets weekly. Therapy was not changed, and he was seen next on May 12, 1954, at which time he reported that he felt very good, had not had any difficulty at all for 4 days, and had not taken any nitroglycerin for that period. He seemed to have a definite personality improvement. The patient was most recently seen on June 17, 1954; he had voluntarily reduced his Pentoxylon dosage to 4 tablets daily and reported excellent subjective improvement. He was aware that his temper flare-ups are no longer triggered by unimportant incidents. During the past month he had on one or two occasions experienced some difficulty but had taken no nitroglycerin.

Despite the very obvious psychogenic overlay I feel that the electrocardiographic alterations cannot be ignored in this patient and that a diagnosis of psychogenic coronary angiospasm is justified. This person was the perfect test tube for this therapy because of his drug idiosyncrasies and the inadequacy of past therapy. The conclusion in this case is that the response to Pentoxylon was excellent.

Case 2. A 54-year-old female complaining of precordial discomfort associated with activity and overeating was first seen as an outpatient on March 15, 1954. The distress was paroxysmal and of about 6 months' duration. The episodes had been only annoying but uncomfortable enough for her to seek aid. Her family history was not pertinent. Her basal electrocardiogram demonstrated the classical and unmistakable pattern of chronic nonfocal coronary heart disease. She was normotensive, and a chest x-ray revealed no hypertrophy. There was mild hypercholesterolemia, but all other laboratory and physical findings were normal. She was placed on PETN therapy with phenobarbital for sedation and was given an injection of calcium and estrogen once weekly for 1 month. She was again seen on April 8, 1954, at which time she admitted improvement but objected to the phenobarbital on the grounds that it made her "stupid." At this visit she was put on Pentoxylon and was seen weekly for the next month. At that time she was checked thoroughly and described very appreciable subjective improvement. She has been kept on 4 tablets daily and was last seen on June 4, 1954, when she volunteered the information that she had not felt so well in a long time. She was at that time not having precordial distress or any symptoms directly referable to the chest. She complained only of mild postprandial gaseous eructations.

This is a well documented and clinically typical case of chronic coronary insufficiency. The patient's last electrocardiogram did not demonstrate any significant normalization of the pattern, but the subjective improvement was most gratifying. The response in this case must be considered as good.

Case 3. A white female, 64 years old, was first seen as an inpatient on the medical service of Normandy Hospital. Her complaint was precordial aching which was periodic, not especially severe, and aggravated by physical effort. She believed the complaint to be of about 7 months' duration. She was sure it was heart trouble and was very apprehensive about the prognosis. There had been no previous diagnosis or treatment, and she had consented to hospitalization in the hope that she could be helped enough to go on "one more vacation." The patient was normotensive, and her nutritional status was good. The retinas demonstrated some atherosclerotic changes. Her basal electrocardiogram was borderline, and, in accord with our heart station rule, hyperbasal studies were not done. The roentgenologist found no evidence of cardiomegaly or pulmonary disease, and all other laboratory and physical findings were noncontributory. Her response to a nitroglycerin therapeutic test was positive. She was given Pentoxylon, 6 tablets daily, beginning on April 24, 1954, and was reinventoried as an outpatient exactly 1 month later. No other drug was used. She reported significant subjective improvement in the precordialgia and planned to leave on her vacation within the week. She has a detached attitude about the prognosis, but still insists that she is moribund. Her electrocardiogram was unchanged. I have not seen this patient since the end of April, but the referring physi-

cian sees her weekly and reports that there have been no exacerbations. She now takes 1 tablet four times a day.

I believe this to be the very ordinary variety of chronic myocardial ischemia due to geriatric vascular inadequacy. The myocardiopathy was not advanced but was certainly responsible for the symptomatology. The clinical response in this case was good.

Case 4. On April 15, 1954, a 42-year-old white man was first seen as an emergency inpatient on the medical service of Normandy Hospital. He complained of a severe crushing pain in the left thorax and shoulder. The episode began suddenly about 4 hours previously and had continued unrelieved. He had had no previous episodes and was working around the house when this occurred. The first electrocardiogram demonstrated the unmistakable stigmata of acute anterior wall myocardial infarction. He was covered with clammy perspiration, was nauseated, and had a rapid pulse with borderline hypotension. Heavy sedation was induced and he was given 1 unit of plasma-volume expander and started immediately on an anticoagulation regimen. Serial electrocardiograms confirmed the diagnosis. The sedimentation rate rose to 112 in less than 1 week. His blood pressure was stabilized at 140/88. At the end of 1 week of treatment he was greatly improved but still complained of chest pain. He was started on 6 Pentoxylon tablets daily, and his blood pressure was checked every 3 hours. No blood pressure changes were noted, and some subjective improvement was observed 4 days after treatment was begun.

Four weeks after the cardiac insult and 3 weeks after Pentoxylon therapy was started, the patient was free of pain, bathroom privileges were permitted, and the anticoagulants were withdrawn. One week later he was discharged remarkably improved and was given a supply of Pentoxylon to be taken four times daily at home. Five days after dismissal he returned to the hospital because of supraventricular tachycardia occasioned by awakening from a bizarre and morbid dream. The tachycardia was promptly and easily controlled with procaine amide, and it was planned for him to return home on the third postadmission day. On the evening of the second day the patient expired suddenly, without clinical prodrome. Pericardicentesis demonstrated copious quantities of free blood in the pericardium, and it was concluded that death was due to rupture of a ventricular aneurysm. Permission for autopsy was denied.

Death in this case was, of course, not associated with the Pentoxylon therapy but did interrupt any long range evaluation. It appears that treatment was accomplishing exactly what it was designed to achieve, that is, producing prolonged coronary vasodilation and allaying apprehension, until the massive vascular accident occurred. I would classify the efficacy of therapy in this case as fair.

Case 5. Two years ago a white 50-year-old female was first seen when she suffered an acute anterior wall infarction which temporarily interrupted the right bundle branch conduction system. During this episode she was treated with xanthine vasodilators and sedatives and recovered uneventfully with no residual electrocardiographic stigmata. She drifted from cardiologist to surgeon after that time and received treatment from each. She is now an employee at Normandy Hospital and thus came again under my observation on the outpatient service. Since her original infarction she has suffered continual episodes of left chest pain which she believed were becoming more severe since her employment. She was placed on Pentoxylon therapy on April 24, 1954 and was told to take 6 tablets a day and report in 2 weeks. Three weeks later she reported that she had taken the medicine for 2 weeks and had noticed some improvement, but had been sick at her stomach and had a slight diarrhea so she had discontinued the medication. Discontinuance of the drug did not cure the symptoms, and she went to a clinic where she was cured with antibiotics. She was advised that it was not the drug that was responsible for her gastrointestinal upset and to resume its use. She promised to do this. She was seen again 2 weeks later when she came in to complain about her chest pain and to report that she had not taken any Pentoxylon for several days because she thought it made her hands itch. She reluctantly admitted that the medication afforded her some relief but that she was constantly afraid she would experience an unpleasant side reaction. Therapy was discontinued.

Obviously this patient had been reading the labels and pamphlets in the drug room and felt it was necessary to have some unpleasant side reaction. It is possible that psychotherapy would have been more effective than vasodilatation. This case is included only because this report concerns the first ten nonselected cases and I feel that it cannot be excluded. The clinical response was inconclusive.

Case 6. This 65-year-old male had been found unconscious at the head of a staircase and was rushed to the hospital by relatives. I was summoned to see him on his fourth postadmission day after a diagnosis of acute posterolateral myocardial infarction had been established. He was in an oxygen tent, his lips were cyanotic and severe dyspnea, extreme apprehension, and an uncountable arrhythmic tachycardia were present. Intravenous digitalization was achieved rapidly, and he was much improved on the following morning. He was maintained on oral digitalis, and on his sixth postadmission day he was started on Pentoxylon therapy because of the residual chest pain. Two weeks later he was sitting at the bedside, free of pain, and looking forward to returning to work. The remainder of his hospital stay was uneventful, and he was discharged at the end of the fifth week.

He was readmitted 1 week later with what appeared to be an anxiety state which occurred when he was told that he had been retired. His hospital stay was short, and he was discharged again and continued on digitalis and Pentoxylon therapy. He had been a very troublesome patient because of waking in the middle of the night, morbid fear of being alone, fear of taking a sedative because he might never awaken, and a generalized fear of everything. He was made aware that his worst enemies were boredom and hysteria and that he would have to make an adjustment to his new and unwanted life situation. This was apparently the correct approach. Cardiologically he has progressed satisfactorily, has maintained a normal blood pressure and pulse rate, and is able to get around and care for himself with no more than usual fatigue. He has had no chest pain for the past month.

This was an instance of acute failure precipitated by acute infarction. The disease was controlled promptly, and the patient's clinical progress followed the customary pattern for a cardiopathy of this type. The

vasodilating effect of Pentoxylon was satisfactory, but the remarkable Rauwiloid effect seen previously was disappointingly absent. The clinical response to Pentoxylon was fair.

Case 7. On April 17, 1954, an inpatient, aged 62, on the medical service, Normandy Hospital, complained of severe dyspnea, orthopnea, nausea, constant chest pain, and vertigo. After a complete examination the diagnosis of decompensating luetic aortic insufficiency was made and the patient was digitalized. For the first 4 days subjective improvement did not parallel clinical improvement owing to the persistent chest pain, anxiety, and apprehension. She was placed on Pentoxylon therapy together with oral digitalis and the standard heart-failure regimen. She was discharged at the end of the third week. She was reinventoried 1 week later, and at this time a remarkable inversion of the clinical-to-subjective improvement ratio was observed. At this visit she was cyanotic, her limbs very edematous, and she was obviously dyspneic; despite all this, she reported that she was getting along all right, and she did not seem particularly disturbed. She was surprised when I suggested re-entry into the hospital but submitted readily. Her venous pressure was elevated to 200 mm. of saline, her diastolic blood pressure had dropped to 20, and she had developed an auricular fibrillation. The afternoon of admission she got out of bed to go to the bathroom and fell dead against the door. Death was due to pulmonary embolism, probably issuing from the fibrillating auricles.

This was a typical case of decompensating luetic cor bovinum, and the heart failure proved to be intractable. I cannot but emphasize the most amazing and gratifying buffer-against-reality effect of Rauwiloid demonstrated in this case. Despite her obvious progressive clinical failure, this previously very antipathic patient's attitude was as if it were happening to someone else. The clinical response to Pentoxylon therapy was good.

Case 8. This 44-year-old female patient was originally referred as an outpatient 3 years previously. Her cardiac history is far too voluminous to be detailed here but is essentially as follows: 8 years ago she was hospitalized for recurring chest pain and, on the basis of a single electrocardiogram, a diagnosis of myocardial infarction was made, and she was put to bed for 2 months. Since that episode she had been unable to be out of bed for any length of time because of utter fatigue (almost like a myasthenia gravis patient) and some precordial discomfort. The patient's abnormal electrocardiographic findings have not changed significantly in the 8 years covered by the seriatim study. The clinician and myself decided 3 years ago that the patient had chronic, nonfocal coronary heart disease and was a self-appointed and unnecessary cardiac invalid. This woman had exhausted the various forms of cardiac therapy from me, from her family doctor, and from several others that she had consulted. All therapy ultimately had failed, and only bed rest could palliate her. On April 15, 1954, all other treatment was stopped and 6 tablets of Pentoxylon daily were prescribed. She was not told that it was a new or experimental drug; rather she was led to believe that it was just another remedy she had not tried as yet. She was reinventoried 1 month later. She was able to come to the office and reported that she had been able to care for herself and accomplish a minimal amount of housework. She stated that there was no question that she was improved. She was seen again 2 weeks later, and told me she had been on a picnic with her children and was able to go to church. She admitted marked subjective improvement. Her electrocardiographic pattern was unaltered. During her seventh week of therapy, her husband's sudden death subjected her to great emotional strain. She suffered a relapse but was able to attend the funeral, and, at this writing, is not the complete invalid that she was, and her progress has taken a positive direction.

This case again emphasizes the effect of Rauwiloid in interposing a pharmacologic buffer between patients and their environment. The clinical response to Pentoxylon was excellent.

Case 9. Left chest pain which was not referred, but which was noticeably precipitated and/or aggravated by physical exertion, was the complaint of a 46-year-old white male who was first seen on April 17, 1954. His basal electrocardiographic record was abnormal and demonstrated chronic, nonfocal changes. He was slightly hypertensive (170/100) and had a borderline sinus acceleration. He had been treated during the previous year by several physicians and had been given small tablets that he placed under his tongue and some large tablets that he took 4 times a day. The latter were identified as a popular Ethaverine product. This therapy had achieved some success but had not totally alleviated the symptoms, and he occasionally had a "hard attack" which disturbed him very much. He was immediately placed on Pentoxylon, 1 tablet six times daily, and was told to continue taking nitroglycerin as needed. He was seen 4 weeks later at which time he reported significant clinical improvement. He had required no nitroglycerin for about 1 week but still carried the tablets with him. He was seen again in his sixth week of therapy and reported he had taken no nitroglycerin since the previous visit although he still carried the vial with him. His electrocardiographic pattern was unaltered, his sinus acceleration had normalized, and his blood pressure had been lowered to 156/90.

This is another clinically typical case of the patient with chronic coronary disease. The hypotensive and bradycrotic effects of Pentoxylon were evidenced in this study, and the subjective improvement was very satisfactory. Nitroglycerin requirements were lessened significantly, and exercise tolerance was increased. The clinical response of this patient was good.

Case 10. Periodic precordial "uneasiness" not appreciably precipitated or aggravated by exertion was the complaint of a pharmacist friend who was first seen professionally on April 6, 1954. The symptom occurred frequently in the evening after the day's work was over and he was resting and, on a few occasions, had awakened him at night. He was not sure how long this had been bothering him but he was aware that the pain had been more frequent and severe in the previous 4 months. He refused hospitalization and an outpatient "work-up" was done. He was slightly overweight and slightly polycythemic. His chest x-ray was normal. The basal electrocardiogram was normal, but after the Master exercise test appreciable changes were noticed and the uneasy sensation was produced. The changes persisted for about 12 minutes. His blood pressure was 150/90. Six tablets of Pentoxylon per day were prescribed and he was not told the nature of the medication. He returned in 6 weeks, at which time he reported that he had had no difficulty in the past 2

or 3 weeks. At this visit his blood pressure was 140/90, and the Master test did not alter his basal electrocardiogram except for rate acceleration. His dosage was reduced to 1 tablet four times a day.

This subclinical type of coronary insufficiency is probably one of the most frequently overlooked entities and explains many of the bizarre and atypical syndromes encountered by the practitioner. The increase in exercise tolerance was probably the most significant finding in this case. The clinical response of this patient was excellent.

DISCUSSION

Clinical results with a new therapy in ten unselected cases of coronary insufficiency are presented. The patients were unselected, and represented a wide variety and degree of cardiopathies, with primary or relative coronary insufficiency as the common denominator.

The pharmacology of Rauwolfia extracts and of pentaerythritol tetranitrate has previously been reported[2,3] and will not be repeated here. Theoretically a bradycardic, tranquilizing, and sedative drug, combined with a long-lasting coronary vasodilator, should supply a more complete therapy for angina pectoris and status anginosus than has previously been available. Our preliminary results confirm the validity of this concept.

In our first ten unselected cases, clinical results could be considered as poor in none; inconclusive in one (10 per cent); fair in two (20 per cent); good in four (40 per cent); and excellent in three (30 per cent).

The results indicate that Pentoxylon is better for long-range therapy of coronary insufficiency than any therapy previously available. The greatest usefulness for the therapy would seem to be in the nonfocal, chronic cases, and the results in this series suggest that the more recent cardiopathies may respond better than the older cases.

Pentoxylon reduced elevated blood pressure levels but had no significant hypotensive effect on blood pressure in normotensive or hypotensive patients. This has been confirmed by other investigators.[4]

There was no evidence of toxicity from the use of the drug, and it was not necessary to discontinue it in any instance because of side actions.

Inasmuch as good clinical response may be somewhat delayed, particularly in chronic cases, the drug should be continued for at least 30 days before its value in any given case is assessed.

CONCLUSIONS

Pentoxylon combination of Rauwolfia extract and pentaerythritol tetranitrate, has been used in ten unselected cases of angina pectoris and status anginosus.

Excellent clinical results were seen in 30 per cent, good results in 40 per cent, fair results in 20 per cent, and inconclusive results in 10 per cent.

No serious, dangerous, or deleterious side actions were observed.

The preliminary results indicate that the therapy shows considerable promise, and further clinical investigation will be pursued.

8424 Engler Park Ct.

Acknowledgment

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TRENDS IN RESPIRATORY CANCER MORTALITY

While the number of deaths reported in the United States from cancer of the respiratory system has been increasing rapidly in the past quarter of a century—from 3,900 in 1930 to almost 27,000 in 1953—approximately half this increase reflects merely the growth and aging of the population, and a considerable part of the remainder represents improved diagnosis and more complete case finding. Nevertheless, there does appear to be an appreciable real rise in the incidence of respiratory cancer, but data are not available to show how much of it can reasonably be attributed to the effect of specific factors.

Both sexes have experienced a rise in the death rate from cancer of the respiratory system, but the increase has been very much more rapid among males than among females. For example, among white males the age-adjusted death rate in 1950 was four times that in 1930, whereas among females the rate had not quite doubled. As a result of the sex difference in trend, the death rate from respiratory cancer among white males had increased to about 4½ times that among white females, whereas in 1930 the corresponding ratio had been only about 2¼ to 1. Even among males, however, respiratory cancer now accounts for only one fifth of the mortality from all cancers.

In each sex, the rise in respiratory cancer mortality has been more rapid in later life than at the younger ages. Between 1930 and 1950, the death rate from this cause among white males increased by about 130 percent at ages 35-44, by 265 percent at ages 45-54, and from about 350 to more than 400 percent at subsequent decennial age periods.

In large measure, the rise in the reported mortality from cancer of the respiratory system has been due to improved diagnostic techniques and more complete case finding. Physicians with good training in diagnosis have greatly increased in number, as have specialists in radiology and bronchoscopy. With more abundant facilities available for diagnosis of respiratory cancer and the more frequent use of radical surgery, many cases of the disease have been uncovered which would have been missed in earlier years. The growing tendency to obtain microscopic confirmation in suspected cases has had the same effect. Furthermore, the sharp declines in the mortality from tuberculosis, pneumonia, and other respiratory diseases have probably resulted in fewer cases of respiratory cancer being unrecognized and attributed to these other diseases.

That much of the recent increase in the recorded mortality from respiratory cancer has resulted from improved diagnosis and more complete case finding is indicated by the geographic variations in the trend of the death rate from the disease. In general, the smallest relative increases between 1940 and 1950 were recorded in the States with the highest death rates in 1940 and the largest increases in the States with the lowest rates. This is consistent with the hypothesis that, in the past, geographic differences in respiratory cancer mortality reflected largely differences in the proportion of such cases detected and reported. — *Statistical Bulletin*, Metropolitan Life Insurance Company, October, 1954.

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IV—RESEARCH AND EDUCATION IN OSTEOPATHY

This editorial is the fourth in a series on the Cole thesis on research and education in osteopathy,[1] which was appraised in the October JOURNAL *as a document which would prove indispensable to the student of medical history, both without and within the osteopathic profession. The editorial series will review the thesis in detail and will attempt to interpret its findings and relate them to living osteopathic history.*

The first question that troubled early osteopathic educators was how to explain the results of osteopathic manipulation. Cole points out that:

> The nervous system was suspected as a prime factor in the disturbed physiology of the spinal column; it was logical to suspect that spinal strains (osteopathic lesions) could affect the nervous system becauses of the anatomical proximity.

There was great difficulty in presenting proof of the reasoning involved

> . . . because prior to 1900 little actual experimentation had been done on the nervous system by either American or British investigators . . . the vast amount . . . that has been done . . . has appeared in the last forty years.

The most important facet of the then prevalent attitude of osteopathic teachers was the stress placed upon the importance of the nervous system and its relationship to the mechanism of the "osteopathic lesion."

> . . . Even though its complete mechanism was not described (nor has it been today) an attempt has been made to establish [its] pathology . . . upon a rational basis of fact, rather than upon fancy.

In his treatment of The Beginnings of Osteopathic Research Cole establishes the historicity of the early research program. As early as 1898-1899 animal experimentation had been done at the American School of Osteopathy (now the Kirksville College of Osteopathy and Surgery) for which equipment had been obtained in Europe. A little later Louisa Burns began conducting "basic animal experiments on the 'osteopathic lesion'" at the Pacific College of Osteopathy (now the College of Osteopathic Physicians and Surgeons). In 1903 Dr. Burns published her first studies on the physiology of the nervous system. Work on the same basic lines as that of Burns was being done during the same period by Carl P. McConnell at Kirksville:

> . . . Specifically he was investigating the response of cells to abnormal stimuli originating in the spinal area. The work was primarily histo-pathological in nature and did indicate the importance of abnormal nerve impulses in the functional capacity of the cell.

Seen in historical perspective, however, all individuals engaged in either basic or clinical osteopathic investigation were working independently of each other. The programs as established in the colleges were sporadic; Cole rates them as "somewhat ineffectual." They become significant when viewed as "the beginnings of the osteopathic research program."

The evidence reveals that osteopathic leaders soon became aware of the ineffectiveness of the research programs as conducted. They insisted that "a more formal and unified approach must be adopted if full utilization of the results of the research programs were to be obtained." The next step taken by the organized profession was the establishment of a research laboratory independent of those established as osteopathic colleges. The A. T. Still Research Institute, founded in 1907, was the result. Cole speaks of it as:

> . . . the first formal step taken by the profession as a whole to establish an adequate research program and provide a means by which such a program could be perpetuated over a period of years. . . . The purposes of the Institute were to "court investigations as a proof of sincerity, establishment of records and to establish the validity of the osteopathic concept." . . .
>
> The plea for results with a practical application was made during this period, as was one for more original work. It was not sufficient to demonstrate that certain functional alterations responded to manipulative therapy; it was even more important to demonstrate and explain the mechanism of the phenomena involved in the entity termed the "osteopathic lesion."
>
> The most significant fact concerning the establishment of the program was the realization that a definite, formal, and controlled program had to be established for basic investigations concerning the validity of the osteopathic concept. Clinically it was possible to apply osteopathic manipulative therapy and to obtain a beneficial response in most cases. However, it was necessary to obtain a complete understanding of such reactions. The A. T. Still Research Institute was the first organized attempt on the part of the osteopathic profession to accomplish this end.

Literature contemporary with the period (1898-1913) reveals specific criticism directed toward the various osteopathic research programs, but which cannot be entirely justified when judged by the documentary evidence available. For example, the claim that none of the work done by osteopathic investigators was found publishable in scientific journals is confuted by articles by W. J. Deason, D.O., working under the auspices of the A. T. Still Research Institute, which were published in the *American Journal of Physiology*. More important than measurable results in any evaluation of osteopathic research is the attitude of the re-

1. Cole, W. V.: The development of osteopathic research and education. Thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts, Northeast Missouri State Teachers College, Kirksville, Mo.

searchers themselves. Cole reports that honest judgments of the results of their experiments, whether of a clinical or a laboratory nature, characterized the investigators. He points out:

> . . . There was no production of unfounded dogmatism used solely to prove the theory of the osteopathic concept . . . no specific claims for the complete substantiation of Still's original platform of osteopathy were made.

In evaluating the beginning period of osteopathic research and education (the first 15 years) Cole states that the projects which were carried on both in the colleges and in the A. T. Still Research Institute may seem "inconsequential and devoid of any definite results when compared to present-day investigative procedure." However, they did establish research as an integral part of osteopathy, and did, to some extent, explain and substantiate some propositions of the osteopathic concept. He concludes that the most valuable result of these early investigations was to convince many leaders in the profession that any delineation of the fallacies or truths of the original osteopathic concept depends upon fundamental and clinical research acceptable to medical science. He maintains that these early efforts laid a foundation upon which the present profession-wide acceptance of the importance of scientific research rests. These early activities established a tradition which in later years made possible the support not only of a greatly expanded research program, but also of a program for the improvement of osteopathic education not approached in any proportionate extent by any other professional group. The roots were struck deep in the period from 1898 to 1913.

The Cole thesis sets up a "middle period" as extending from 1913 to 1935. While historical studies fix periods or epochs quite arbitrarily, they do possess a basis in fact, obtained by an examination of a total period, including a detailed study of sufficient contemporary documents to establish trends. The point where a trend or trends becomes an actual movement is usually taken as the point to determine the beginning of a period or epoch, lasting until it has apparently run its course. This useful method has long served scholars and students alike, who recognize that such an artificial time division is merely a device to simplify historical study. A study of osteopathic research and education is simplified by this method, and the periods established by Cole's careful documentation seem entirely accurate.

The Editor of the American Osteopathic Association, writing recently on the status of osteopathy, past, present, and future, arrived independently at a similar division of the osteopathic movement. He has termed its earliest phase one of "emergence," extending from the profession's beginning to the middle of the second decade of this century, the period when osteopathy emerged as a reform movement from the medical practice of the turn of the century; its clinical phase was considered as extending from midway in the second decade until the beginning of the fifth decade (the 1940's), a period of trial in which the profession proved largely to society that it was a new and distinctive school for the unlimited practice of medicine; and its present period was rated as the phase of challenge, in which the profession is called upon by society to fill the role which is being rapidly created for it—leaders in a movement for the continuous reorientation of medicine.

Cole's thesis on osteopathic research and education reveals its middle period, (i.e., its clinical phase) as one of slowly increasing social acceptance of the osteopathic physician. And it was a period in which the clinical application of manipulative therapy was given a rigorous test in actual practice.

Extravagant claims made by enthusiasm-dominated practitioners of the first years became much fewer. The osteopathic literature of the period no longer contained the extravagant claims that first characterized its publication. It was a settling period in which the profession's primary interest lay in determining clinically what its practitioners could accomplish with a distinctive therapy.

> A clinical evaluation of spinal mechanics and gross structural problems attracted the attention of several osteopathic clinicians and they reported their findings concerning treatment of low back problems and disease in general.

However, the advantages of manipulation were so thoroughly established that osteopathy was equated with manipulation in the mind of the public generally and, in many instances, in the mind of the individual doctor.

Osteopathic physicians generally recognized, however, that osteopathy was not manipulation, and that they should not confuse a modality, no matter how useful and distinctive it might be, with osteopathic medicine—a term which came into use in the latter part of this period, as did the term "osteopathic physician," replacing the more popular "osteopath."

It was a period in which there was a determined effort to seek a rationale for manipulative therapy—to justify its use. At the same time many osteopathic physicians became largely concerned that they be worthy of the clinical acceptance they were receiving from society. If manipulative therapy did not appear in certain instances to do the whole job, there was the determination to discharge fully their obligations to their patients, that is, to employ any and all measures which would best aid the patient in his recovery. Osteopathic theoreticians spoke more frequently of the employment of "adjuncts" in osteopathic care — a euphemism to avoid categorizing any modality other than manipulative treatment as an agent of primary value in the treatment of disease. The word "adjuncts" still appears occasionally in osteopathic literature, although many osteopathic writers consider its use anachronistic.

Cole notes that this middle period of osteopathic development was paralleled by tremendous advances in medicine and pharmacy. The continuum of medicine was continually being enriched. The practice of doctors of medicine was revolutionized by advances in medical science. Purge, vomit, blister, and bleed, to the accompaniment of a shotgun polypharmacy—Still's medical heritage—became largely a thing of the past. Medical teaching and practice was deeply concerned with a growing knowledge of the use and misuse of drugs as therapy. Osteopathic physicians of this period were also concerned. Many able doctors of medicine were frankly nihilistic concerning any and all therapy; many

doctors of osteopathy were frankly questioning themselves as to what should be employed therapeutically in those cases where there seemed no primary rationale for manipulative therapy. Or they sought to ascertain the rationale of manipulation when it was particularly effective.

THE CONTRIBUTION OF THE BIOLOGIC SCIENCES TO OSTEOPATHY*

The same established facts and the same generally accepted theories in the biologic sciences which are used and taught in all schools of the healing arts are taught in osteopathic institutions. This is true of the past as well as today.

Osteopathic institutions differ from other schools of medicine in two major ways: first, in the emphasis placed on the study of certain biologic systems, and, second, in relation to certain implications in the existing body of biologic facts and principles and the inferences drawn therefrom. These differences have stemmed from a combination of clinical observations and inductive reasoning. In broad terms they center around evidence (a) that the human musculoskeletal framework is poorly adapted to a biped stance and is vulnerable to gravitational and other stresses, (b) that the state of various components of this framework influence and are influenced by the state of other systems, presumably through nervous, hormonal, and vascular connections, and (c) that appropriate therapy applied to all systems often has major remote as well as local effect.

Up until a few years ago the emphasis on these differences, for a variety of reasons, was largely in their clinical application, with the accumulation of information concerning the biologic mechanisms involved lagging far behind.

When biologic information concerning these differences finally began to catch up with clinical observations, this information appeared, primarily, in the field of physiology. It is of interest to note that when this biologic information did begin to emerge it did not bear on the musculoskeletal system per se. Instead it appeared in studies of the central and vegetative nervous systems which dealt largely with the pain mechanisms of disease, of various experimental procedures, and of reflex thresholds in the spinal cord.

Probably the earliest important physiologic contribution in this area was the postulation by Sir James Mackenzie of "the irritable focus" of the spinal cord. Mackenzie had found hyperesthesia of what he considered normal vertebral spines in diseases of such viscera as the heart, stomach, liver, and uterus. He reasoned that the hyperesthesia was an exaggerated response to stimuli reaching a pool of internuncial neurons which was already in a state of subliminal excitation as the result of a barrage of impulses from the segmentally related diseased viscus. It is now apparent that this approach was, at least, greatly oversimplified and, in the light of current knowledge, open to certain serious questions. It is also evident that the assumption that the vertebral spines were normal was incorrect since we now know that there is palpable abnormality in the paravertebral tissues which are segmentally related to pathology in another system. However, Mackenzie's observations did point up the fact that many visceral diseases have a somatic component even though the relative importance of this component in the total disease process has not been identified.

Physiology, along with the other disciplines in biology and biophysics, continues to offer important opportunities for work which provides a better understanding of this somatic component. Recently, work such as that of Lewis and Kellgren, Travell and Rinzler, Korr and his colleagues, and our own observations in the Kirksville laboratories has established the fact that derangements in the reflex activity of the spinal cord, and presumably of other parts of the nervous system, are part and parcel of many diseases and dysfunctions. This work has contributed to the understanding of the importance of somatovisceral interrelationships and their influence on the functioning of the human organism as a whole, and has identified questions which are vital to the present and future advance of knowledge involving the prevention, recognition, and management of disease.

Here the needs for such future advances of knowledge include a combination of new biologic concepts, experimental programs, and clinical observations. A few of these needs, possibly the most important needs at this time, can be identified specifically. Even at the risk of appearing to exclude or ignore other important areas, four examples will be cited.

In broad terms, we need a better understanding of (a) the sensory, reflex center, and motor mechanisms concerned with gravitational and other stress in both the human biped and the quadruped and the relationships these mechanisms have with other mechanisms in the functioning of the total organism in both health and disease; (b) the horizontal or segmental aspects of reflex activity of the spinal cord, particularly in the human, including somatoautonomic interchange; (c) the nervous, hormonal, and vascular influences on trophic processes of all kinds, especially in muscle and collagenous tissues; and (d) the local and remote effect of manipulative treatment of various kinds directed to the musculoskeletal system.

From the practical standpoint, if these scientific objectives are valid, there are specific needs which are involved in their pursuit.

Again, speaking in broad terms, the basic needs can be specifically identified. These needs involve personnel and facilities.

The personnel for this work has been, and will continue to be, drawn primarily from two groups. One group is made up of clinicians who are experienced in the recognition and management of derangements of the musculoskeletal system and who either know or who have the interest and capacity to learn research

*This editorial is an expansion of an essay written for the Survey of Physiological Sciences undertaken by the American Physiological Society. The Survey is discussed further on page 299 of this issue of THE JOURNAL.

methods. The other group is composed of research investigators who have the training and capacity to recognize important questions in this area and who can adapt their special skills to the seeking of the necessary answers.

The facility needs, in general terms, include physical plant space and technical apparatus which will permit and encourage the recruitment of top level personnel for this work in both the clinical and biologic sciences.

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THE OREL F. MARTIN MEDAL

The Annual Clinical Assembly of the American College of Osteopathic Surgeons recently held in Dallas, Texas, and reported editorially in the December JOURNAL, was especially marked by a memorable event—the presentation of the first Orel F. Martin Medal to Dr. Martin himself.

In the creation of the medal in 1953, the Board of Governors of the College has followed a tradition of 3,000 years. Commemorative pieces play such an important role in depicting the advance of Western Civilization that they could be used as a point of departure from which to write its history. It is true that medallic art has been most often employed to acclaim war and conquest—Napoleon is said to have kept a crew of artists and artisans busy immortalizing his victories—but its use to pay tribute to advances in literature, aviation, architecture, music, religion, and medicine is not less important.

It is fitting that the College chose this historic medium to express its appreciation to Dr. Orel F. Martin, who has been long a distinguished surgeon of the profession. Its selection of Dr. Martin, however, was much more immediate in intent. The College of Osteopathic Surgeons is one of the profession's distinctive organizations. Its leaders have always been able men; its membership is of the highest calibre. However, it was the creative, dedicated, and devoted efforts of Orel Martin, continued tirelessly over many years, that gave form and substance to the College until it became in its own right an organization capable of exercising influence and wielding power. The College is now a body of such strength as to give capable men an authority greater than they possess as individuals, and so nurture young men of capacity as well as to aid and abet them.

The annual award of the well-known Distinguished Service Certificate of the American Osteopathic Association, the creation of the Trenery medal by the American Osteopathic College of Radiology and its first award in 1953 to Dr. Trenery's widow, and the execution and award of the first Orel F. Martin medal in 1954, are all representative of distinctive professional achievement but, in their totality, they are evidence of a profession's gratitude to men who have so honored the profession that they in turn merit honor.

SURVEY OF THE BUREAU OF INDUSTRIAL AND INSTITUTIONAL SERVICE

The osteopathic population of the United States, nearing 13,000, is being asked to take part in an important survey. The Bureau of Industrial and Institutional Service of the American Osteopathic Association is asking osteopathic physicians to check the answers to ten questions mailed to them on January 15, 1955, and to return the questionnaire in a postage-free, self-addressed envelope to the Association's headquarters in Chicago.

The purpose of the questionnaire is to determine accurately the role which our doctors play in a vital aspect of the nation's life, that of industrial health. One of the interesting by-products of the study made by the President's Commission on the Health Needs of the Nation was the establishment of the fact that no estimate of total health care in the United States can be made without taking into account osteopathic physicians. Other sources indicate that we are responsible for approximately 6 per cent of the health care of the people. These reckonings are indicative of the breadth of our responsibility.

Our further advance as one of the two unlimited sectors of the healing arts depends upon our ability as a profession to assume our share of the problems that are incident to every aspect of medical care. Our philosophy of medicine enables us to make a distinctive contribution to the solution of industrial health problems, if we give these our serious and concerted attention. The Bureau, by means of this survey, is taking the first necessary step: to find out exactly what we are doing as a profession today in the field of occupational health as the first requisite to knowing what we can and should do tomorrow. Therefore, no osteopathic physician should fail to answer the first two questions on the questionnaire even if both answers are "No."

In an article reprinted in THE JOURNAL, March, 1952, Herbert K. Abrams, M.D., Chief, Bureau of Adult Health, California State Department of Health, termed industrial health "a total public health responsibility." He emphasized "Occupational health is not merely the prevention of industrial accidents, important as this is. . . . It is a composite of all of the things that affect the health of working men and working women by virtue of the conditions of life that go with their particular occupations." Further, as a phase of social medicine, occupational health is "the science of health as it is related to the world about us."

Medicine is rapidly leaving its too-long-confined doctor-patient relationship. This does not mean the importance of the individual and his problem is lessened, but that human beings are being caught up in a swirl of economic, social, and political currents, global in sweep. The physician who best ministers to the one must see him in his relationship to the many. And of such will be the doctor of tomorrow.

Medicine in its totality is being challenged by society as never before. Osteopathic medicine is challenged on two counts—the one, as a recognized sector of the healing arts profession to fulfill its social obliga-

tions; the other, to vindicate its own distinctive claims. It is on a phase of the first count that the Bureau of Industrial and Institutional Service is making its appeal at this time.

All readers may not sense immediately the importance of the questionnaire. Just now the really important thing is to fill it out and return it to Chicago in the envelope provided.

Notes and Comments

An Application of Osteopathic Principles to Visual Problems.—

"The Effectiveness of Therapeutic Procedures as Dependent Upon the Rationale Underlying Them," published in the September, 1954, issue of the *American Journal of Optometry and Archives of American Academy of Optometry*, is both a significant article and one of special interest to the osteopathic profession. The *American Journal of Optometry* is a scientific publication of the optometric profession and the official publication of the American Academy of Optometry. The author, S. Howard Bartley, Ph.D., of the Department of Psychology, Michigan State College, East Lansing, Michigan, is an authority in a field allied to optometry, osteopathic medicine, and allopathic medicine. An editorial comment prefacing the article, which is presented as a "Special Report," notes that the paper does not necessarily express "the general thinking of optometry nor of the Academy" and that it "seems unduly critical of allopathic medicine." It is pointed out, however, that Dr. Bartley's evaluation is "conductive to much serious study dealing with self-evaluation and with the possible technics and approaches to be used by optometrists in the future."

Dr. Bartley has drawn a striking analogy between the osteopathy-allopathy issue and the optometry-ophthalmology, at the theory-and-practice level. The paper will interest osteopathic physicians generally, but it should be of very special interest to osteopathic ophthalmologists. They, like their optometric colleagues and certainly like the allopathic ophthalmologists, may not agree with all of the author's conclusions, but they cannot fail to be challenged—and perhaps stimulated—in their thinking. Osteopathic ophthalmologists will immediately recognize the approach to visual problems as organismal in character, that is one which is directly related to fundamentals of the osteopathic concept.

Bartley's short critique is based on the premise that "a coherent and comprehensive rationale even for practical procedures is very helpful."

Two papers, "The Somatic Approach to the Disease Process" and "The Emerging Concept of the Osteopathic Lesion," written by Irvin M. Korr, Ph.D., and published in THE JOURNAL OF THE AMERICAN OSTEOPATHIC ASSOCIATION, suggest a rationale for the optometric profession.

The article outlines Korr's discussion of osteopathic philosophy as he contrasts it generally with the allopathic point of view which lacks, he holds, a definitive rationale or philosophy of health and disease. Following a resume of Korr's formulations, Bartley asks: "Now, what has this contrast between two therapeutic philosophies to do with optometry?" And then comes his contribution.

He reminds his optometric readers that theirs is "a self-critical profession, an arch promoter of every move to understand vision as a human performance rather than to deal with eyes as local organs that can be medicated and excised." He then points out that "ophthalmology . . . has busied itself with eye-care and localized ocular therapy. When anything is to be done about the broader features of human performance involving vision, it is left to some other specialty." He goes on to say:

> . . . [Ophthalmological] treatment of defective vision lies solely in detecting localized malfunction and compensating for it by artificial means. The most usual etiological factor is the optical condition of the eye itself, through some intrinsic change or through some invading pathogen. . . . The reason ophthalmologists look with grave suspicion and doubt upon doing anything other than prescribing glasses and performing surgery for visual troubles is that they expect to do nothing until indubitable symptomatology shows up, and, then, true to the allopathic outlook, reversal of performance is thought unlikely or impossible. Ophthalmology never suspects that something about visual care can precede gross symptomatology.

In contradistinction to the ophthalmologic approach, Bartley states:

> The modern optometric view not only leaves the door open for possible manipulation of organismic functioning but actively attempts it.
>
> The optometric therapist does one or both of two things. *He changes the environment* by interposing certain optical items between the eye and the visual target or field of the patient, and he *changes certain patient reactions to his environment.* Part of the latter is produced incidentally by the use of the glasses and part is produced by visual training which involves various devices both instructional and instrumental.

These comments on the Bartley paper are not sufficient to present his position accurately (the entire paper merits careful study). Neither does this review presume that Bartley's interpretation of allopathic ophthalmology might not be sharply criticized as inadequate by the latter school of practice. It is sufficient to say Bartley is a physiologist—more precisely a physiological psychologist—who is well known for his work on visual mechanism, sensory physiology, and fatigue.

Osteopathic physicians will be stimulated by this paper, not merely because osteopathic philosophy is brought into it, but because its application to another field of medical science is suggestive of the elements of universality which it appears to hold.

★ ★ ★

Biologic Sciences and Osteopathy.—

During the past 2 years the American Physiological Society, with substantial financial assistance from the National Science Foundation, has conducted a Sur-

vey of the Physiological Sciences. Dr. Ralph W. Gerard, University of Illinois, is chairman, Dr. Wallace O. Fenn, University of Rochester, cochairman, and Dr. L. M. N. Bach, director. One of the objectives of the Survey has been to assess the "contributions made by physiology to the tremendous variety of clinical agricultural and other scientific fields in which physiologists work." To accomplish this, about 100 people in different fields were asked to write short essays concerning the role of physiology in their field. Dr. J. S. Denslow, Director of Research, Kirksville College of Osteopathy and Surgery, and a member of the Society, was asked to write concerning the role of physiology in osteopathy. Denslow enlarged the essay somewhat so that it might be used as an editorial in THE JOURNAL. It is published in this issue.

Department of Public Affairs

DONALD M. DONISTHORPE, D.O.
Chairman
Los Angeles

BUREAU OF PUBLIC EDUCATION ON HEALTH

CARL E. MORRISON, D.O.
Chairman
St. Cloud, Minn.

COUNTY HOSPITAL DECISION OF MICHIGAN SUPREME COURT

The Bureau of Public Education on Health has long recognized the importance of available hospital facilities to all physicians and surgeons. A patient denied for the first time the services of the physician or surgeon of his choice in a hospital in a time of need feels, with drastic effect, the impact of interference with the physician-patient relationship. By and large the most important cases of interference with the physician-patient relationships result from hospital bylaws and regulations. The Michigan Supreme Court on November 29, 1954, rendered a decision in a case involving the legality of hospital bylaws, rules, and regulations which excluded a doctor of medicine from the Gogebic County Public Hospital (also known as the Grand View Hospital). The doctor of medicine and his patients filed a bill for an injunction restraining the hospital officers and staff from excluding the physician. The statute in question is one almost identical to the county hospital law of Missouri which was at issue in the Audrain County Hospital case. No doctors of osteopathy were involved in the Michigan case, but the decision itself is of importance, nonetheless, to the osteopathic profession for it lends support to the long-held policy of the American Osteopathic Association that public hospitals constructed and supported with tax funds should be available for the care of all the people. Such public hospitals are established primarily for the citizens in the area—so that they may have at their own expense a hospital in which they may receive care in time of illness. The Michigan Supreme Court in this case could find no basis in law for a decision or ruling that denied to the citizens this right of theirs. The Court held that under the statute the patient is accorded "the *absolute* right to employ the physician or nurse of his or her own choice," and that the rules of the hospital trustees or medical staff had to be consistent with this statutory grant, not in contravention. The rules and regulations, the Court said, could not suspend the statute.

STATE OF MICHIGAN
SUPREME COURT

SAMUEL G. ALBERT, JAMES C. WILLIAMS, ALBERT BEHRENDT, JR., and EILEEN BEHRENDT,
Plaintiffs and Appellees,
vs.
BOARD OF TRUSTEES OF GOGEBIC COUNTY PUBLIC HOSPITAL, also known as GRAND VIEW HOSPITAL; THE MEDICAL STAFF OF GOGEBIC COUNTY PUBLIC HOSPITAL, an unincorporated voluntary association, club or society; WILLIAM H. WACEK and FRANK DRAZKOWSKI, JR.,
Defendants and Appellants.

Filed November 29, 1954

BEFORE THE ENTIRE BENCH.
REID, J.

Plaintiffs filed a bill for an injunction restraining defendants from preventing plaintiff Dr. Albert from practicing medicine and surgery in the county hospital (a public hospital) and from preventing other plaintiffs (patients) from the use of the facilities of the county hospital and also enjoining defendants from enforcing as against plaintiffs, certain by-laws, rules and regulations of the board of trustees of the defendant hospital, and for other relief. The court disposed of the case on the pleadings after answer was filed and some testimony taken. From a decree for plaintiffs, defendants appeal.

The validity of certain rules adopted by the defendant board, by which the defendant board assumed to regulate the practice of medicine and surgery in the public hospital, is the controlling issue in this case.

The plaintiffs are Samuel G. Albert, a physician and surgeon, licensed by the state board of registration in medicine (see CL 1948, Sec. 338.51, 338.53 [Stat Ann Par. 14.531, 14.533]) to practice medicine and surgery in Michigan, residing at Ironwood in Gogebic county, and James C. Williams and Mr. and Mrs. Albert Behrendt, Jr., patients of plaintiff Albert, who also reside in Gogebic county. Grand View hospital is Gogebic county public hospital and the only public hospital in the county. Plaintiffs claim that each of the plaintiffs is entitled to the use of the facilities of Grand View hospital under the terms of the county hospital act, PA 1913, No. 350, and under such of the rules and regulations of defendant board of trustees as are lawful.

Defendant board of trustees is a body corporate and is the governing body of Grand View hospital. Neither the defendant board of trustees nor any of its members is licensed to practice medicine. Defendant medical staff is an unincorporated voluntary association composed of 24 physicians and surgeons licensed to practice either in Michigan or Wisconsin or in both states. Defendant medical staff was formed in this state and conducts its business therein and is known as "medical staff of Grand View hospital." Although individual members of the defendant medical staff are licensed practitioners of medicine, defendant medical staff itself is not so licensed.

Defendant William H. Wacek is a licensed physician and surgeon but not a member of defendant medical staff. He is the resident physician of Grand View hospital, employed as such by defendant board of trustees. Defendant Drazkowski is administrator or general manager of Gogebic county public hospital, employed as such by defendant board of trustees.

Grand View hospital was established under the provisions of the county hospital act, PA 1913, No. 350, as amended (CL 1948, Par. 331.151 et seq. [Stat Ann Par. 14.1131 et seq.]) and is supported at present by public funds as contemplated by such act. It contains approximately 100 beds, more than half of which are in the general section of the hospital. In addition to Grand View hospital, three small private hospitals of 20 beds each are located in Gogebic county. Grand View hospital serves an area including parts of Ontonagon and Iron counties in Michigan and Iron county in the state of Wisconsin. It seems that Iron county, Wisconsin, has no hospital and that Ontonagon county, Michigan, has one 20 bed public hospital while Iron county, Michigan, has one 17 bed public hospital and one 20 bed private hospital.

The 17 year old daughter of plaintiff Williams was denied admission to Grand View hospital just prior to August 30, 1951, unless she would agree to select a doctor other than Dr. Albert. Plaintiffs Behrendt were unable to have their two minor daughters admitted to Grand View hospital on August 24, 1951, unless they agreed to select for the care of said daughters in said hospital, a physician other than Dr. Albert.

Plaintiffs ask that certain rules and regulations (among other rules) adopted by the medical staff (defendant) and approved by the defendant board be treated by the court as void and defendants enjoined from enforcing them, particularly articles V, VI, VII, XVI, XVII, XXIII, XXIV, XXV, XXVI, XXVIII, XXIX, XXXII and XXXIII, which are as follows:

"ARTICLE V

"The medical staff of this hospital shall consist of physicians and surgeons who have been licensed to practice medicine and surgery in the State of Michigan by the State board of registration in medicine and who have been organized as a medical staff of this hospital and have complied with all the rules and requirements in regard to obtaining membership on the staff, according to the rules and regulations adopted by the trustees.

"The staff shall be divided into two (2) divisions—senior and junior. All general practitioners and specialists who reside in the county of Gogebic or the county of Ontonagon, Michigan, or the county of Iron, Wisconsin, who are licensed to practice

in Michigan and who have practiced twenty (20) years shall be members of the senior division of the staff.

"The board of trustees shall thereafter admit such physicians and surgeons to the staff as they shall deem qualified and who possess the other qualifications herein set forth, and shall classify such physicians and surgeons as either senior or junior members. In making such selections and classifications they may consider the recommendations of the senior staff members.

"Any member of the junior division may be advanced to the senior division at any time the board of trustees shall deem such junior member qualified. In making such advancement, the board of trustees may consider the recommendations of the senior staff members.

"Physicians and surgeons desiring to be admitted to the staff shall make application on the form provided by the board of trustees.

"ARTICLE VI

"No physician or surgeon shall perform a major operation in this hospital unless he is a member of the senior staff or has in attendance, prepared for assisting in the operation, one or more senior members of the staff of this hospital in addition to the person qualified to administer anesthesia.

"A major operation is one which involves a serious hazard to the life of the patient.

"ARTICLE VII

"No patient shall be admitted to this hospital for any operation or treatment unless under the direction of some licensed physician or surgeon, according to the rules and regulations of this hospital, except in case of an emergency.

"ARTICLE XVI

"No person shall be allowed to practice medicine in this hospital unless he has in full force and effect a license from the State of Michigan to practice medicine and surgery in all its branches in the State of Michigan and who is in good standing in the medical profession, and is physically and morally and mentally qualified to practice his profession.

"ARTICLE XVII

"No person claiming to be a physician and surgeon, who is not a member of the senior or junior staff and who is not accompanied by some member of the senior or junior staff, shall practice in this hospital until he has submitted to the superintendent his license to practice medicine in the State of Michigan, or otherwise shown to the superintendent that he is duly licensed to practice medicine as a physician or surgeon.

"ARTICLE XXIII

"Any reputable non-resident physician may bring his patients to the hospital for treatment but must leave them in charge of a member of the staff of this hospital. Any member of the staff shall not be considered a non-resident within the meaning of this article. Non-resident physicians and surgeons shall be those not residing in either Gogebic county or Ontonagon county, Michigan, or Iron county, Wisconsin.

"ARTICLE XXIV

"The attending physician shall be held responsible for a complete record of the patient for the hospital files; this record shall include identification, date, complaints, personal history, family history, history of present illness, physical examination, special reports, such as consultations, clinical laboratory, x-ray and others; provisional diagnosis, medical or surgical treatment, pathological findings, gross and microscopic; progress notes; final diagnosis; condition on discharge; follow up record; and autopsy findings when such autopsy has been performed. This record shall always be up to date.

"ARTICLE XXV

A complete history, physical examination record and working diagnosis shall be completed within thirty-six hours after admission and except in emergency, shall be required prior to operation. No case record shall be filed until complete. All records are the property of the hospital and must not be taken away, but the patient or physician may obtain copies or abstracts on request by furnishing the proper legal instruments. Patients to be operated on in the morning shall be in the hospital by 4 p.m. the day previous.

"ARTICLE XXVI

"All operations performed are to be fully described. All tissues removed at operation are the property of the hospital and must be examined by a competent pathologist, whose report shall form a part of the patient's record.

"ARTICLE XXVIII

"No Caesarian operation shall be performed upon a patient except after consultation between the operating surgeon and a senior member of the staff, and the consultant has filed a report on a form prescribed by the board of trustees with the superintendent of the hospital. And in all Caesarian sections, the indications for the operation, including especially the history of the previous deliveries, x-ray pelvimetry and symptoms threatening toxemias must be fully recorded.

"ARTICLE XXIX

"No operation for 'sterilization' shall be permitted without a previously signed statement from the patient, her husband or his wife (as the case may be) or a responsible member of the family.

"Consultation with a senior member of the staff is also imperative before operation."

"ARTICLE XXXII

"The medical staff shall adopt such rules and regulations as may be necessary for the proper conduct of its work. Such rules and regulations may be amended at any regular meeting without previous notice by a ⅔ vote of the total membership of the medical staff. Provided that such rules do not conflict with rules and regulations adopted by the board of trustees and provided that they do not infringe upon the powers of the board of trustees.

"ARTICLE XXXIII

"The board of trustees reserves the right to remove any member of the medical staff or to deprive any physician or surgeon of the privileges of the hospital whenever, in their sole judgment, the good of the hospital or of the patients therein demand it; and it reserves the right at any time of making any changes in these rules, by amendment, addition, substitution, repeal or revision, as in its judgment may seem for the best interests of the hospital and those who are to become patients therein."

Defendants claim that there are ill consequences of allowing physicians and surgeons to practice in the public hospital, who are legally licensed as physicians and surgeons, but not admitted specially to practice in and by the public hospital. As against such claim of the defendants, it is the claim of the plaintiffs in this case that as far back as 1946, plaintiff Albert was successfully performing surgery, which defendant medical staff through its surgical committee claimed he might be well qualified to perform, but should not be allowed to perform without payment of fee of $25 per operation as an "observation" fee exacted by the medical defendants; that from about February 24, 1950 until about November 1, 1950, plaintiff Albert was allowed to practice in Grand View hospital without interference from defendants and without observable ill consequences; and that from the time the injunction was issued on September 4, 1951, plaintiff Albert has been allowed to practice in Grand View hospital according to the dictates of his own medical knowledge and without the interference on the part of defendants.

No ill consequences to patients resulting from plaintiff Albert's practice in the hospital are alleged in defendants' pleadings, nor in any testimony referred to in defendants' brief.

The bill alleges that on December 30, 1946, the defendant board held a hearing on which the charge against plaintiff Albert was that he had performed a laparotomy and resection of the ureter which defendant board and defendant medical staff claimed he was not permitted to under the rules of said staff then in effect and pertaining to Grand View hospital. The bill further alleges that on or about August 21, 1951, the defendant board adopted a resolution barring plaintiff Albert from bringing patients to Grand View hospital, practicing medicine and surgery in said hospital, and from the use of the facilities of the hospital, claiming that plaintiff had violated Articles VI, XXIV, XXV, XXVI, XXVIII and XXIX of the rules and regulations.

Defendants insisted that the hospital board had power to make rules limiting practice of medicine and surgery in the hospital to classes designated by medical staff set up by article V; and defendants introduced some testimony to prove the reasonableness of rules in dispute.

The statute, PA 1913, No. 350, does not in any portion of the act, undertake to delegate to any board, person or persons the right to suspend by rule or otherwise the right to practice medicine and surgery granted by the State board and in no part of the act of 1913 is there any express or implied modification of PA 1899, No. 237 (CL 1948, Par. 338.51, Stat Ann Par. 14.531) regarding practice of medicine and surgery. The right given the hospital board to make rule evidently in general for administrative ("economic and equitable") purposes, is not a right to suspend or control treatment or operation on patients by a duly licensed practitioner. No such meaning should be read into Par. 10 of the act of 1913.

A Florida Case, Green v. City of St. Petersburg, 154 Fla 399, 17 S2d 517, relied on by defendants as showing the authority of public hospital boards to make rules such as those made by defendants and in question in this case, contains no suggestion that the rules limiting practice in the public hospital in the Green Case violated or in part suspended any Florida state license or was in conflict with any Florida statute.

Defendants cite Illinois and Indiana cases as to the rule-making power of county (public) hospitals: Selden v. Sterling, 316 Ill App 455, 45 NE 2d 329, and Hamilton County Hospital v. Andrews (Ind), 81 NE 2d 699. The Indiana opinion cites and relies on the Illinois case. The Illinois statute with broad and inclusive language expressly makes the physician, nurses and "all persons approaching or coming within the limits of the hospital", subject to the rules and regulations adopted by the board, while in the hospital. The Illinois statute is much broader and more inclusive in that particular than the Michigan statute.

The Michigan statute, differing from the Illinois statute, has three sections in which the rule-making power of county hospital boards is referred to. Section 10 of the act, CL 1948, Sec. 331.160, Stat Ann Sec. 14.1139, in part is as follows:

"Such hospital always being subject to such reasonable rules and regulations as said board may adopt in order to render the use of said hospital of the greatest benefit to the greatest number; and said board may exclude from the use of such hospital any and all inhabitants and persons who shall wilfully violate such rules and regulations."

In Sec. 4, CL 1948, Sec. 331.154, Stat Ann Sec. 14.1134, is the following:

"The board of hospital trustees shall make and adopt such by-laws, rules and regulations for its own guidance and for the government of the hospital as may be deemed expedient for the economic and equitable conduct thereof not inconsistent with this act, and the ordinances of the city or town wherein such public hospital is located."

Also, in Sec. 13 of the act, CL 1948, Sec. 331.163, Stat Ann Sec. 14.1142, is the following:

"The patient shall have absolute right to employ at his or her own expense his or her own physician or nurse, and when

acting for any patient in such hospital the physician employed by such patient shall have exclusive charge of the care and treatment of such patient, and nurses therein shall as to such patient be subject to the directions of such physician, subject always to such rules and regulations as shall be established by the board of trustees under the provisions of this act."

It is to be noted that in Sec. 13 the legislature indicates that the board's rule must be "under" not "in suspension of" "the provisions of this act."

The statute sets forth the absolute right of the patient to be attended by his or her choice of licensed practitioners.

Whether the rules in controversy in this case shall be considered as made under Sec. 10 or Sec. 4 or Sec. 13 of the act, or under all three sections, it is clearly our duty to declare void, any rule inconsistent with the act of the State legislature covering the subject matter. This was expressly indicated in Sec. 4 of the act and is to be implied in regard to Sec. 10 and 13.

The objectives for adoption of rules set forth in Sec. 4 are the guidance of the board, and economic and equitable conduct of the hospital: in Sec. 10 the objective is to render the use of the hospital of greatest benefit to the greatest number. In Sec. 13 the patient is accorded the *absolute* right to employ the physician or nurse of his or her own choice and that such physician so employed shall have exclusive care of the patient subject to the board's rules established under (but not in suspension of) the provisions of the act of the legislature. In no section of the act is there any suggestion that the hospital board may suspend even partially the license of a regularly licensed practitioner. Suspension is left with the State board of registration in medicine. See CL 1948, Sec. 338.53, Seventh subd (Stat Ann Sec. 14.533, Seventh subd).

The license of plaintiff Albert granted him by the State Board includes practice in public hospitals and shall be presumed to continue in such public hospitals until suspended or interrupted by some clearly and lawfully empowered authority.

Plaintiffs stress that the senior surgeon required by criticized rules to be present at a major operation, is not required to be one who has performed or even witnessed such major operation and that mere lapse of time is substituted for proven knowledge and skill of the required onlooker. Plaintiffs claim that at one period at least Dr. Albert was required to pay a fee (or "kick-back") of $25 for each operation where the "on-looker" was required by the board.

Defendants criticise plaintiff Dr. Albert for not making records required by the rules in question, in the hospital of details of treatment of cases. Plaintiffs justify Dr. Albert under Mass. Mut. Ins. Co. v. Trustees, 178 Mich 193, which see. See also, CL 1948, Sec. 617.62, Stat Ann Sec. 27.911, which in part is as follows:

> "No person duly authorized to practice medicine or surgery shall be allowed to disclose any information which he may have acquired in attending any patient in his professional character, and which information was necessary to enable him to prescribe for such patient as a physician, or to do any act for him as a surgeon."

In their motion for decree on the pleadings (after partial taking of testimony) plaintiffs limit the issue to the question of the power of defendant board to make the rules in dispute, and the parties agreed that the trial court might consider the testimony so far as taken. The trial court accepted and acted upon such limitation of the issues. In consequence, such issues as noncompliance and "kick-back" are not before us for decision. We further need not determine whether the medical staff is dominated by practitioners willing to deprive plaintiff Albert of practice so that they may share it among themselves.

We do not in this case determine the nature or limitation of the management or control of State institutions, such being not in issue herein.

Among other things the trial judge found as follows:

> "13. Purporting to act under authority given to them by the county hospital act and claiming to act under color of law defendant board of trustees on August 21, 1951, issued an order barring plaintiff Albert from practicing medicine and surgery in Grand View hospital for alleged infraction of articles VI, XXIV, XXV, XXVI, XXVIII and XXIX of the 1950 rules of defendant board."
>
> "14. On August 23, 1951, Diane Lee, of the age of 4 years, and Gloria Jean, of the age of 2 years, infant daughters of plaintiffs Behrendt, became ill, suffering with fever and pain in the neck and legs. The Behrendts communicated with plaintiff Albert who advised hospitalization for said children whereupon plaintiffs Behrendt took said children to Grand View hospital but were unable to procure the admission of said children as patients in said hospital unless they chose as physician for said children someone other than plaintiff Albert. Similar refusal was made in the case of Mary Ellen, daughter of plaintiff James C. Williams, who was advised that plaintiff Albert was not permitted to practice in Grand View hospital and that she could not be admitted as a patient of plaintiff Albert."
>
> "15. Defendant board of trustees has no power, by rule, regulation or otherwise, to regulate the practice of medicine and surgery in Grand View hospital."
>
> "16. Articles V, VI, VII, XVI, XVII, XXIII, XXVIII, XXIX and XXXIII of the 1950 rules and regulations of defendant board of trustees, as placed in effect on November 1, 1950, do so attempt to regulate the practice of medicine and surgery in Grand View hospital, and consequently they are void and of no effect and the same are hereby set aside."
>
> "17. All lawful power to discipline any duly licensed physician and surgeon, or to suspend or revoke his right to practice in any public hospital organized and existing under PA 1913, No. 350, as amended, in [is] exclusively committed to the state board of registration in medicine and is accordingly determinable by and in pursuance of the medical practice act and article XXXIII of said 1950 rules is accordingly void as an attempted usurpation of powers, duties, and procedure set forth in the medical practice act, and the same is hereby set aside."

We conclude that the trial court was correct in his decision as far as quoted, and that articles V, VI, VII, XVI, XVII, XXIII, XXVIII, XXIX, XXXII and XXXIII are without the power and authority of the defendant hospital board to adopt and are void.

The decree appealed from provided that articles XXIV, XXV and XXVI shall be complied with after the decree by plaintiff Albert unless and until at a future hearing, said articles shall be shown and found to be improper or beyond the power and authority of the board to adopt. Plaintiffs request that the decree be affirmed. The case is remanded to the trial court for a hearing on and determination of the validity of said three articles upon petition of plaintiffs. The decree appealed from is affirmed. No costs, a matter and questions of public importance being involved.

Department of Public Relations

CHESTER D. SWOPE, D.O.
Chairman
Washington

DIRECT BLOOD PRESSURE READINGS

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE
NATIONAL INSTITUTES OF HEALTH

A dependable, inexpensive, easily portable apparatus for making *direct* blood pressure readings has been developed by the Laboratory of Technical Development of the National Heart Institute, Public Health Service, U. S. Department of Health, Education, and Welfare. This device, when attached to a conventional electrocardiograph, produces accurate pressure recordings formerly available only by the use of costly and complex instruments.

Physicians find the customary inflated cuff method of taking an *indirect* blood pressure reading satisfactory for most diagnostic purposes. Occasionally, however, to obtain very precise measurements, doctors need to read blood pressure directly within the blood vessel. The complicated apparatus heretofore required for doing this usually has been available only in special clinics or large hospitals. With the new development, physicians now can utilize their own electrocardiographs to record pressures taken through a strain gauge pressure pickup.

F. W. Noble, M.E.E.; J. J. Callaway, M.D.; and B. B. Boone, M.D., of the National Heart Institute, recently described the new instrument in the *Journal of Laboratory and Clinical Medicine*. Modifying a commercially available strain gauge type manometer, they added a switch and capacitors so that information about direct blood pressure is translated into an electrical form acceptable to the conventional electrocardiograph. A technical development linking and improving upon existing instrumentation, this new method has been demonstrated to be dependable and satisfactory in clinical trials. It is expected to provide savings in time and expense over present techniques and apparatus.

ATTEND HEALTH OFFICERS CONFERENCE

At the invitation of the Surgeon General of the Public Health Service, Dr. Leonard A. Scheele, representatives of the American Osteopathic Association attended the Fifty-Third Annual Conference of the Surgeon General with the State and Territorial Health Officers, representatives of state hospital survey and construction agencies, and state mental health authorities held December 6-10, 1954, in Washington, D. C.

The Conference recommended that the State and Territorial Health Officers appoint a committee to work with the

Public Health Service in developing patterns of State legislation applicable to local health units; that the STHO encourage development of the PHS Inactive Reserve Corps and work closely with PHS in establishing areas of recruitment and training and utilization of this Inactive Reserve Corps; that the PHS study need for amendments to the Hill-Burton Act relative to housing community health services in nonprofit voluntary general hospital projects; that the Secretary of Health, Education, and Welfare be requested to initiate discussion with representatives of State Hospital Survey and Construction authorities relative to the proposed June 30, 1957, termination date of the program and its effect on fulfillment of the program's purposes. These were among the more important recommendations.

The Association of STHO recommended that with respect to Hill-Burton facilities the states continue their project appraisal activities and that they broaden the scope of such activities to include all of the types of facilities which have received assistance under the program, and that in the development of new state plans, the states continue their cooperation with related health groups, particularly with state and local medical societies, nursing homes, rehabilitation groups, and accrediting agencies, and that in the development of a plan the state agency implement the medical facilities section of the act through the continuing surveys of the existing hospital construction program in order to provide a proper evaluation of need and of anticipated usage of facilities as a basis for an integrated plan for construction, and that state hospital authorities and state mental health authorities cooperate in relation to surveys and planning. These were among the more important recommendations. Among the resolutions of the Association of STHO were a resolution strongly recommending that Congress enact legislation designating the Public Health Service as a component branch of the Armed Forces of the United States on an equal status with the Army, Navy, and Air Force, copies of the resolution to be furnished for distribution by the health officers of each state or territory to all representatives in the Congress from his state, and a resolution (copy to be sent to the National Health Council) that state health councils—or where no state health council exists, any interested statewide voluntary organization—be urged to call or stimulate the calling of statewide meetings of health agencies, civic and service organizations, professional associations, and labor, management and farm groups for the purpose of (a) assessing progress in the development and financing of local official health services and (b) devising action programs designed to enlist citizen interest and support of adequate local health programs, and that STHO participate in such meetings and furnish financial data, including the impact of federal grants-in-aid on health programs in their respective states.

Book Notices

DISEASES OF THE SKIN for Practitioners and Students. By George Clinton Andrews, M.D., F.A.C.P., Clinical Professor of Dermatology, College of Physicians and Surgeons, Columbia University; Attending Dermatologist to the Presbyterian Hospital, Columbia-Presbyterian Medical Center, New York. Ed. 4. Cloth. Pp. 877, with illustrations. Price $13.00. W. B. Saunders Company, West Washington Square, Philadelphia 5, 1954.

One has to live with a textbook to attain a maximum understanding of the author's interpretation. But even on short acquaintance it is evident that this new edition of Andrews' text, the fourth, stands up well in the company of other excellent dermatologic texts that have been revised since the war. Commendable, particularly for student use, is the lack of confusing discussion of the etiology of disease processes, at the same time that the coverage of diseases of the skin is the most complete of that in any dermatologic text known to the reviewers. Aphthous fever (foot and mouth disease), cat scratch disease, and the long list of eponymic diseases that are characteristic of dermatology appear completely covered. Syndromes comprising skin disorders, such as the Plummer-Vinson and the Stryker-Halbeisen, are covered at least to the extent that correlation with internal medicine texts can be accomplished.

The scope of the book is international, with emphasis on the clinical aspects of tropical diseases. The quality of the paper, the binding and the printing is superior. One complaint to be registered is that many of the illustrations have been used over and over in other texts with their credit lines. In all other respects this book is most excellent for students and internists and, in the opinion of the reviewers, indispensable to dermatologists.

A. P. Ulbrich, D.O.
D. Koprince, D.O.

MANIC-DEPRESSIVE DISEASE. Clinical and Psychiatric Significance. By John D. Campbell, M.D.; Diplomate, American Board Psychiatry and Neurology; Fellow, American Psychiatric Association; Attending Psychiatrist, Georgia Baptist Hospital and St. Joseph's Infirmary, Atlanta; Chief Psychiatrist, Peachtree Sanitarium, Atlanta; Captain, MC, U.S.N.R. Cloth. Pp. 403. Price $6.75. J. B. Lippincott Company, East Washington Square, Philadelphia 5, 1953.

The objective of this book is stated in its first paragraph: "One of the oldest diseases known to man, manic-depressive psychosis is much more prevalent and significant in medicine than most physicians now realize . . . . there is needed very much today an organization of previously recorded facts, assimilated with more recent observations, presented in a concise, readable manner for the benefit of students and practitioners of medicine."

Reasons that the prevalence of the disease is not more generally recognized are because of failure to diagnose it or confusing it with some other condition and because the great majority of cases—four out of five—are mild and never reach an institution or a psychiatrist. Even psychiatrists tend to misdiagnose many of these cases.

The author gives a brief history of the condition and a description of the cycloid personality. Next, and very interestingly and uniquely, he discusses the autonomic disturbances found in the disease. This is amplified a little further on in the book by relating the autonomic nervous system and its function to the disease.

A detailed description of the symptoms and emotional expression of the manic-depressive patient is given with rather vivid pictures of the psychotic states. From this point on, the book deals with aspects of the condition not usually covered, such as the psychosis in children and adolescents, the cyclothymic personality in children, fine points of differential diagnosis, social and sexual maladjustments attending the expression of the illness, and the hazards of homicide and suicide.

There is an extensive discussion of the treatment and handling of manic-depressive cases. The treatment of mild cases is divided into ten steps: first, proper diagnosis; second, explanation of somatic symptoms; third, removal of precipitating or aggravating environmental factors; fourth, combating conscientiousness; fifth, psychotherapy; sixth, advice to family and friends; seventh, rest and relaxation; eighth, occupational therapy; ninth, bibliotherapy; and tenth, the use of drugs. He goes further and elaborates on the use of the physical therapies, which are limited to electroshock, electrostimulation, and psychosurgery.

Regardless of whether one believes or agrees with Dr. Campbell's premises, the book is worth the study of any physician. It is questionable whether manic-depressive disease is as widespread as he contends, but being aware of the signs as he gives them will at least guarantee the patient a more careful scrutiny.

Thomas J. Meyers, PH.D., D.O., F.A.C.N.

PRIMER OF ALLERGY. A Guidebook for Those Who Must Find Their Way Through the Mazes of This Strange and Tantalizing State. By Warren T. Vaughan, M.S., M.D., Richmond, Virginia. Ed. 4, revised by J. Harvey Black, M.D., Dallas, Tex. Cloth. Pp. 191, with illustrations. Price $4.25. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1954.

As mysterious as allergies may still be, enough has been found out about them since the first edition of this book was published in 1939 that a fourth edition was found necessary. The method of presentation devised by the author of the original text proved so successful that the revisions by Dr. Black have retained the general outline and merely added the new knowledge accumulated that would meet more completely the needs of the reader. Realistically, no promises of permanent cures for allergies are made. However, hope for relief is given to those who suffer from chronic hay fever, hives, eczema, sick headaches, or indigestion.

The preface states, ". . . we hope this book will serve a useful purpose in telling the patient about his illness, what can be done about it, and how intelligent cooperation makes good results possible. If it fulfills this purpose we shall be pleased." From all indications, those responsible for this book have good reason to "be pleased," for they have provided the allergy-hounded reader with a truly helpful primer.

CURRENT THERAPY 1954. Latest Approved Methods of Treatment For The Practicing Physician. Edited by Howard F. Conn, M.D. Cloth. Pp. 898. Price $11.00. W. B. Saunders Company, West Washington Square, Philadelphia 5, 1954.

Once again, Dr. Howard F. Conn has assembled twelve consulting editors, each a specialist in a different field, and produced the sixth annual edition of "Current Therapy." The original purpose of the series is retained—that of "bringing to the busy physician authoritative, current methods of treatment in a form so devised as to make the desired information readily available."

Of the nearly 400 contributors to the edition, 192 are new. In every instance, the authors are actively engaged in treating the diseases of which they write and evaluating the drugs prescribed. Articles on new subjects include those on yellow fever, vitamin A deficiency, and bullous dermatoses. The chapter on rheumatic fever was shifted from the section on Diseases of the Cardiovascular System to that on The Infectious Diseases. Material in section ten, The Allergic Diseases, has been rearranged.

Naturally, some valuable information from the previous volume is retained with only slight modification. For, as is stated in the preface, "It is obvious that radical changes in the therapy of certain diseases will not take place each year, but it should be of interest to the physician to know whether the therapy has or has not been changed."

HOW TO HELP OLDER PEOPLE. A Guide for You and Your Family. By Julietta K. Arthur. Cloth. Pp. 500. Price $4.95. J. B. Lippincott Company, East Washington Square, Philadelphia 5, 1954.

Each day a thousand more persons join the 65-years-and-over age group, which already numbers over 13 million and is the second fastest growing segment of the nation's population. Unfortunately and even tragically, this miracle of prolonged life brought about by medical, scientific, and technologic advances has been tarnished by cultural lag, which has cast upon society and the individuals who compose it the difficult problem of providing for the welfare and happiness of the aged. Specialists in the medical and social work fields have long pondered and toiled to find solutions, but most of them have "hidden" their observations and conclusions in technical papers. This was the cue for Mrs. Arthur to delve into the specialized publications, consult with experts in geriatrics and gerontology, listen to questions posed by troubled young people, and interview the old people themselves. And here is the result—a book for all laymen that discusses two questions of vital interest to nearly everyone: (1) What can I do for and with the older people who are closest to me? (2) How can I best prepare to meet my old age?

Mrs. Arthur is humble in her approach to the problem. "This book . . . does not attempt to offer an easy, push-button solution to the complicated problems the aging process presents in our time. The reader may even be disappointed to learn that there is no easy solution to any question which affects old people," she writes in the foreword. Nevertheless, she discusses sensibly the everyday problems of the average family in planning with and for its older members. Appendices covering more than 100 pages and suggestions for helpful reading at the end of each chapter are provided as a further aid to the reader.

The value of the book is capably summed up by the publishers thus: "This is not a how-to-live tract but a book of *facts*—facts that may spell the difference between unhappy groping around and an intelligent program with regard to older people."

This book can well be recommended by doctors to the families of all of their older patients.

A PRIMER OF CONGESTIVE HEART FAILURE. By George E. Burch, M.D., F.A.C.P., Henderson Professor of Medicine, Tulane University School of Medicine; Physician-in-Chief, Tulane Unit, Charity Hospital; Consultant in Cardiovascular Diseases, Ochsner Clinic, New Orleans, Louisiana. Cloth. Pp. 126. Price $4.00. Charles C Thomas, Publisher, 301-327 East Lawrence Ave., Springfield, Ill., 1954.

Condensed into four chapters, this primer presents the current concepts on the mechanism and management of congestive heart failure, which is among the most frequent and most serious diseases besetting man today. No attempt has been made to cover every aspect of the subject, but there is enough here to assist medical students, young graduates of medicine, and general practitioners in understanding this malady and arousing further interest in it.

The chapters are on Mechanism, Treatment, Digitalis, and Mercurial Diuretics. "Because digitalis and mercurial diuretics are employed so extensively in this disease state, these drugs are discussed in separate chapters, with special emphasis on their practical use," the author explains. The first two chapters contain line drawings, which should prove helpful. Reference lists are provided at the end of each chapter for those who wish to do further reading on the subject.

MAY'S MANUAL OF THE DISEASES OF THE EYE. For Students and General Practitioners. Revised and edited by Charles A. Perera, M.D., Associate Clinical Professor, College of Physicians and Surgeons, Columbia University, New York; Attending Ophthalmologist, Presbyterian Hospital, New York. Ed. 21. Cloth. Pp. 512, with illustrations. Price $6.00. Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1953.

The twenty-first edition of this familiar manual maintains the intention of the author to present a useful textbook of interest primarily to medical students and general practitioners. The size is the same—it is still a small, but comprehensive, manual of the diseases of the eye and the fundamental facts of ophthalmology.

The volume has, however, been revised in order to delete obsolete material and bring up to date such information as the use of cortisone and corticotropin in allergic and inflammatory diseases of the eye, antibiotics in ophthalmology, Krönlein's operation, retrolental fibroplasia, and scleral resection in the treatment of separation of the retina. The appendix, dealing with ocular requirements of the armed services, has been revised, and twenty-five new colored illustrations, replacing old drawings, have been included.

Readers will find this edition a concise, practical, and systematic guide to the diseases of the eye, intended to perpetuate the memory of the late author, Charles H. May, a great teacher of ophthalmology.